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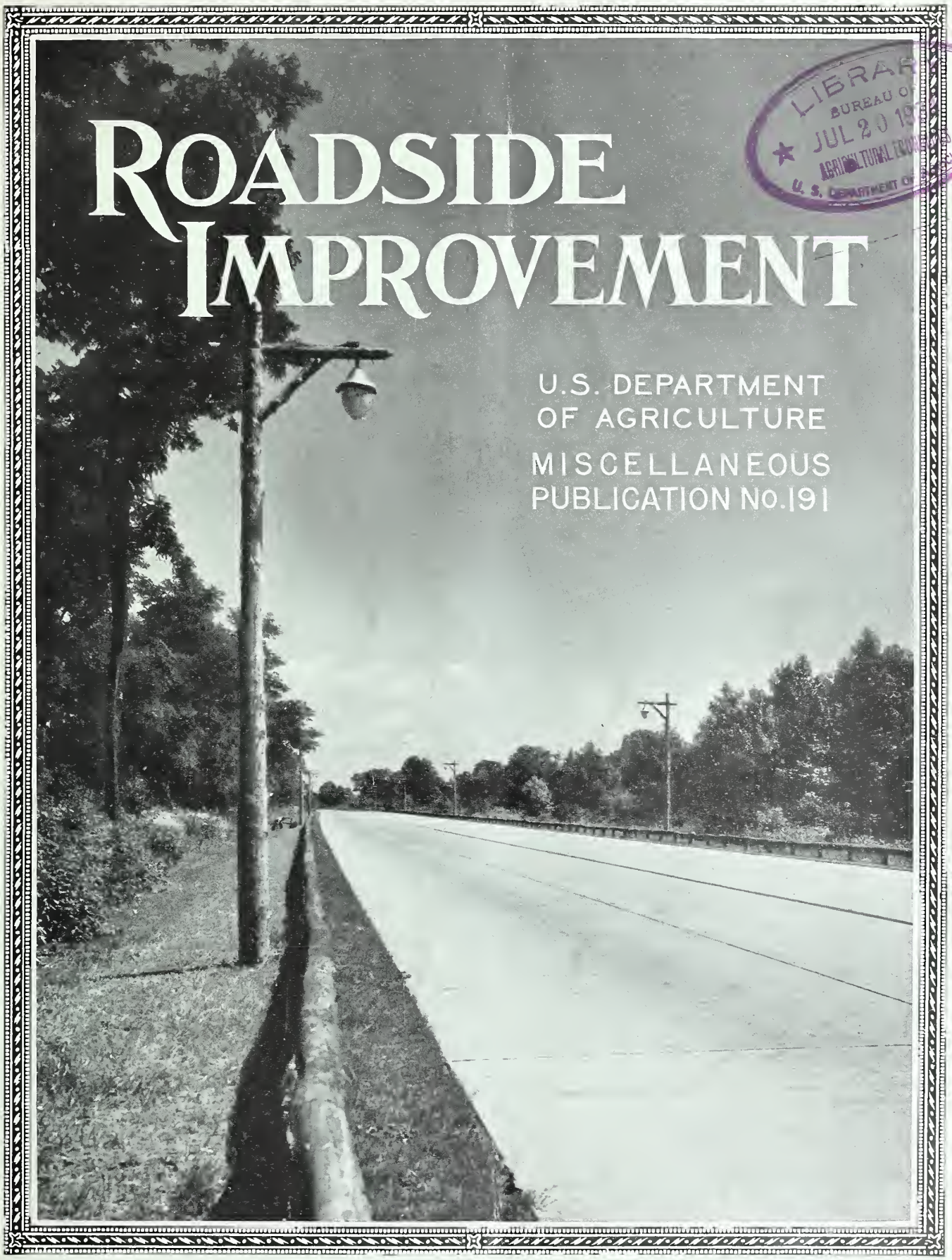

ROADSIDE IMPROVEMENT

U.S. DEPARTMENT OF AGRICULTURE

MISCELLANEOUS PUBLICATION No. 191

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UNITED STATES DEPARTMENT OF AGRICULTURE

MISCELLANEOUS PUBLICATION No. 191

Washington, D.C., June 1934

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ROADSIDE IMPROVEMENT

By WILBUR H. SIMONSON, *Senior Landscape Architect, Division of Design*, and R. E. ROYALL, *Senior Highway Engineer, Division of Information, Bureau of Public Roads* [1]

ROADSIDE improvement is rapidly coming to be recognized as one of the necessary elements of highway construction. Massachusetts appears to have been the first to begin this work, having started in 1912. We now have progressed to the point where a number of States have taken steps toward roadside improvement, such as the employment of landscape architects to direct the work, the budgeting of funds, and the passage of laws authorizing roadside work, the acquiring of the right-of-way, and the protection of roadsides.

The mileage of roadsides actually improved is small, but the accomplishment thus far includes outstanding projects such as the developments in Westchester County and on Long Island, N.Y., and the Mount Vernon Memorial Highway near Washington, D.C., and it has served to create a growing popular demand for such improvement.

In the past, highway engineers and officials, of necessity, have devoted their efforts to the extension of mileage of road construction, with only slight attention to aesthetic features. The requirements of highway users have brought about changes in engineering practice with regard to grades, curvature, and width of surface. It is believed that a majority of our highway users now desire that highway improvement include the roadside as well as the road surface.

RECOMMENDATIONS

The following recommendations prepared by the joint committee on roadside development of the American Association of State Highway Officials and the Highway Research Board are presented here because of their importance in the development of roadside improvement.

1. Every road-building agency should include a person competent to design and carry out roadside-development work. His work should be considered an essential part of the design, construction, and maintenance.

2. Absolute control of the highway right-of-way and all its appurtenances should be vested in the highway authority.

3. Highway authorities should have power to acquire adequate right-of-way for present or future roadside development. They should also be empowered to keep or acquire title or easements in strips or parcels of land along the highway for the benefit and enjoyment of the public.

4. Highway authorities should budget a definite part of their funds for roadside development and its maintenance.

5. There should be cooperation by the highway authorities with individuals, organizations, and local communities interested in roadside development.

A SECTION OF THE MOUNT VERNON MEMORIAL HIGHWAY.

[1] Photographs by J. K. Hillers except as otherwise indicated.

A, THE APPROACH TO WASHINGTON OVER THE OLD ROAD FROM THE SOUTH; *B*, VIRGIN TERRITORY WITHIN A SHORT DISTANCE OF THE FIRST PICTURE AND ON THE NEW LOCATION OF THE MOUNT VERNON MEMORIAL HIGHWAY; *C*, THE COMPLETED HIGHWAY AT SAME LOCATION NOW USED BY PASSENGER VEHICLES APPROACHING WASHINGTON.

Highway traffic is to a considerable extent recreational; people from city and village are attracted by the varied charm of the open country. These people desire attractive roadsides because of a love of natural beauty, and the moderate costs of improvement are justified on their account. For those who desire a direct return on every investment there is the tourist traffic to be considered. This traffic will seek the routes of greatest beauty, as it always has in the past, and leave money behind in payment for gasoline, meals, lodgings, garage services, and incidental expenditures. It is estimated that highway tourists expended about $274,000,000 in Michigan from July 1930 through June 1931.

ROADSIDE IMPROVEMENT IN THE PUBLIC WORKS HIGHWAY PROGRAM

In its administration of Federal-aid road construction the Bureau of Public Roads for some years has been favorably inclined toward improvement of the condition of the roadsides. In 1928 an amendment of Federal-aid legislation permitted the planting of shade trees as part of Federal-aid improvement, but imposed no requirement in this respect.

In section 6 of the rules and regulations for carrying out the emergency road construction provided for by the National Industrial Recovery Act, the Federal authorities have gone a step farther. Certain classes of work are listed as worthy of prior consideration in the planning of the program for expending the $400,000,000 appropriated by the act specifically for highway construction; and high in this list is included " . . . the appropriate landscaping of parkways or roadsides on a reasonably extensive mileage. . . ."

Following the issuance of the rules and regulations, the requirements with respect to roadside improvement were explained and amplified in a memorandum under date of June 30, 1933, addressed to district engineers of the Bureau of Public Roads by the Chief of Bureau, as follows:

> It will be required that each State highway department include in its program of construction on the Federal-aid highway system a definite number of projects that will provide for the appropriate landscaping of parkways or road-

AN INFORMAL ARRANGEMENT OF CEDARS. SOME OF THESE ARE NATURAL GROWTH. OTHERS HAVE BEEN TRANSPLANTED FROM THE ROADWAY OR NEARBY LOCATIONS.

BRIDGES DESIGNED TO BE IN HARMONY WITH LANDSCAPED SURROUNDINGS. GRADING AND LANDSCAPING NOT YET COMPLETED.

sides. Projects of this character should preferably be selected adjacent to the corporate limits of the larger cities in the State, particularly where sufficient right-of-way is available to undertake work of this character. This work shall embrace the selective cutting or pruning of existing growth, the removal of stumps, dead material, etc., the obliteration of borrow pits, traces of old roads and other construction scars, the flattening of slopes, the rounding of slope intersections, the seeding or sodding of shoulders and slopes, and the planting of a sufficient amount of suitable material to accomplish a reasonably comprehensive roadside improvement. The planting of trees at regular intervals without regard to their environment or the composition of adjacent plant growth will not be considered as satisfactory roadside improvement work. Properly qualified landscape architects or horticulturists should be employed by the State highway departments to determine the proper kinds of plant material to be used in different soil and climatic conditions and the most effective arrangement or grouping of such material for any particular location.

No maximum limit has been set on the amount of the Federal funds available to a State that may be used for roadside work, but the State highway departments have been notified that not less than 0.5 percent of the sum allotted to each State must be reserved and expended for such purposes. In imposing this requirement the Chief of the Bureau of Public Roads emphasized that the particular percentage mentioned is not to be construed as the recommended allotment to roadside-improvement projects, but rather as the minimum compliance with the requirements of the rules and regulations that will be accepted under any circumstances.

It is the expectation of the Bureau that roadside landscaping will have a regular place in highway construction in the future. In the work to be done in the immediate future it is the purpose

A NATURAL GROWTH OF WILD RICE ALONG THE HIGHWAY BORDER. NATIVE GROWTH SUCH AS THIS REQUIRES NO INTRODUCED PLANTING. AN EXCELLENT REFUGE FOR WILD LIFE.

to bring about in all States a number of demonstrations of the possibility of pleasing roadside treatment at moderate cost and to develop methods and organizations that will be necessary to carry on similar work on an extensive mileage in the future.

Roadside-improvement projects are handled in the same manner as other road work administered by the Bureau. Projects preferably should be on main arteries of travel. Improvements may be made in connection with the construction of new road surfaces or may be made independently of any other improvement of the roadway and without regard to whether there has been Federal participation in previous construction. Federal funds are not available for purchase of right-of-way.

Initiative in selecting projects for improvement rests with the State highway departments, which also are required to make surveys, prepare plans and specifications, let contracts, and supervise the work done. All of these steps are subject to the approval of the Secretary of Agriculture, acting through the Bureau of Public Roads.

Work may be performed under contract or by State forces. Purchases of planting material for work to be done with State forces must be made on the basis of competitive bidding after advertising for bids and without discrimination against bidders from other States. Conditions of employment of labor, hours of labor, and wages of labor are subject to the rules and regulations governing Public Works highway projects.

It is not practicable to formulate detailed rules regarding landscaping and planting. It is a field of work that is at present almost undeveloped, and much improvement in methods and practice can be expected. Progress should not be retarded by excessive standardization at this time. In fact, it is doubtful whether detailed standardization will ever be desirable, since variety and change are the essence of roadside charm.

The following pages are intended to present a brief review of roadside-improvement practices.

WILD UNDERGROWTH AND TANGLE ON THE HIGHWAY LOCATION. TREES TO BE SAVED HAVE BEEN CLEARLY MARKED.

SAME LOCATION WITH CLEARING AND ROUGH GRADING COMPLETED.

COMPLETED PROJECT. NOTE LOCATION TO FIT NATURAL CONTOURS, ROUNDED SLOPES, ABSENCE OF DITCHES, RUSTIC GUARD RAIL AND RESULT OF SELECTIVE CUTTING. GROUND IS SEEDED BUT SOD NOT YET ESTABLISHED.

A GOOD EXAMPLE OF SELECTIVE CUTTING. AREA AT THE LEFT OF THE ROAD HAS APPEARANCE OF A NATURAL PARK. ON THE RIGHT GROWTH HAS BEEN CLEARED TO OPEN VISTAS OF RIVER. THE CLUMP OF CEDARS IN THE DISTANCE ADDS A TOUCH OF BEAUTY.

STATE ORGANIZATION FOR LANDSCAPING

Satisfactory roadside improvement can be obtained only under the direction of men trained in landscape and horticultural work. Highway engineers can doubtless apply many of the principles which have been developed, such as those affecting grading operations, but they have neither the time nor the training required for landscape work.

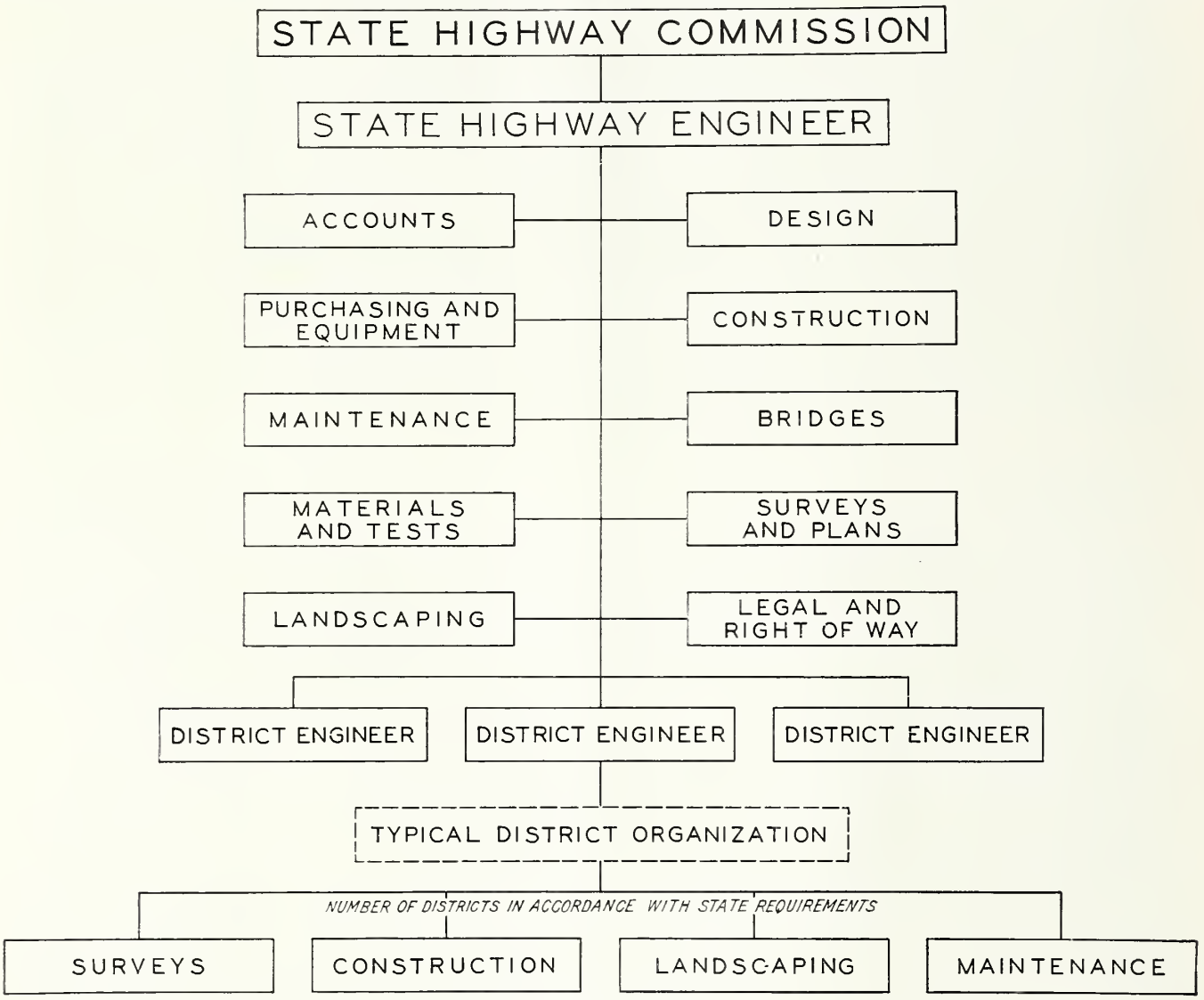


FIGURE 1.—TYPICAL ORGANIZATION OF A STATE HIGHWAY DEPARTMENT. LANDSCAPE PERSONNEL SHOULD BE INCLUDED IN BOTH THE HEADQUARTERS AND FIELD ORGANIZATIONS.

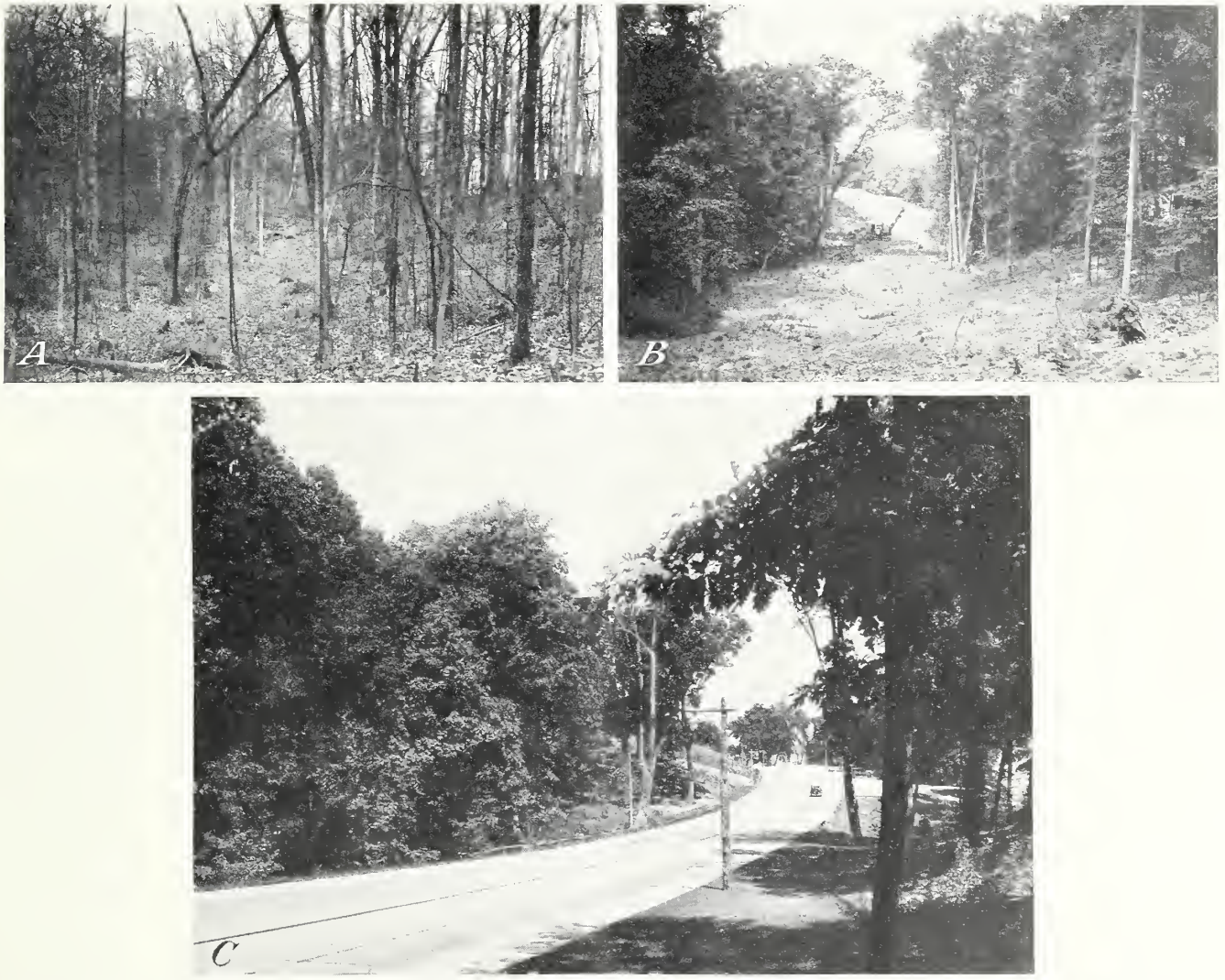
Figure 1 shows one possible form of State landscaping organization, including a division at headquarters which should be in charge of a landscape architect. Landscaping considerations will affect highway location, clearing on new locations, grading, and construction. The chief landscape architect should therefore be in close touch with the various engineering divisions and work with them in formulating standard plans, specifications, and policies. He should also prepare general instructions for the landscaping field forces.

Where work must be planned immediately and there is no landscape organization, it may be desirable to employ the services of a consulting landscape architect to direct the work. A permanent organization should be effected as soon as practicable.

A comprehensive program may require a landscape architect in each district office and trained men working under his direction in accordance

with the number of projects. The landscaping forces, varying in size with the extent of the program, will work in close contact with the regular engineering forces from the inception of a project, through the planning stage and during construction. The final preparation of soil, seeding, and planting generally will follow construction operations. Besides directing the original improvement, the landscape personnel should also supervise the maintenance of the plantings. The work may be performed by the regular road-maintenance forces or by special forces employed solely for landscape work.

State highway departments vary considerably in the details of their organization. All of them, however, coordinate the activities of specialists in various lines, such as surveys, bridges, materials, and construction of surfaces, and landscaping should be included.



STAGES IN TRANSITION FROM A TANGLED WOODLAND TO AN ATTRACTIVE ROADSIDE. NATURALNESS IS THE KEYNOTE OF THIS TREATMENT.

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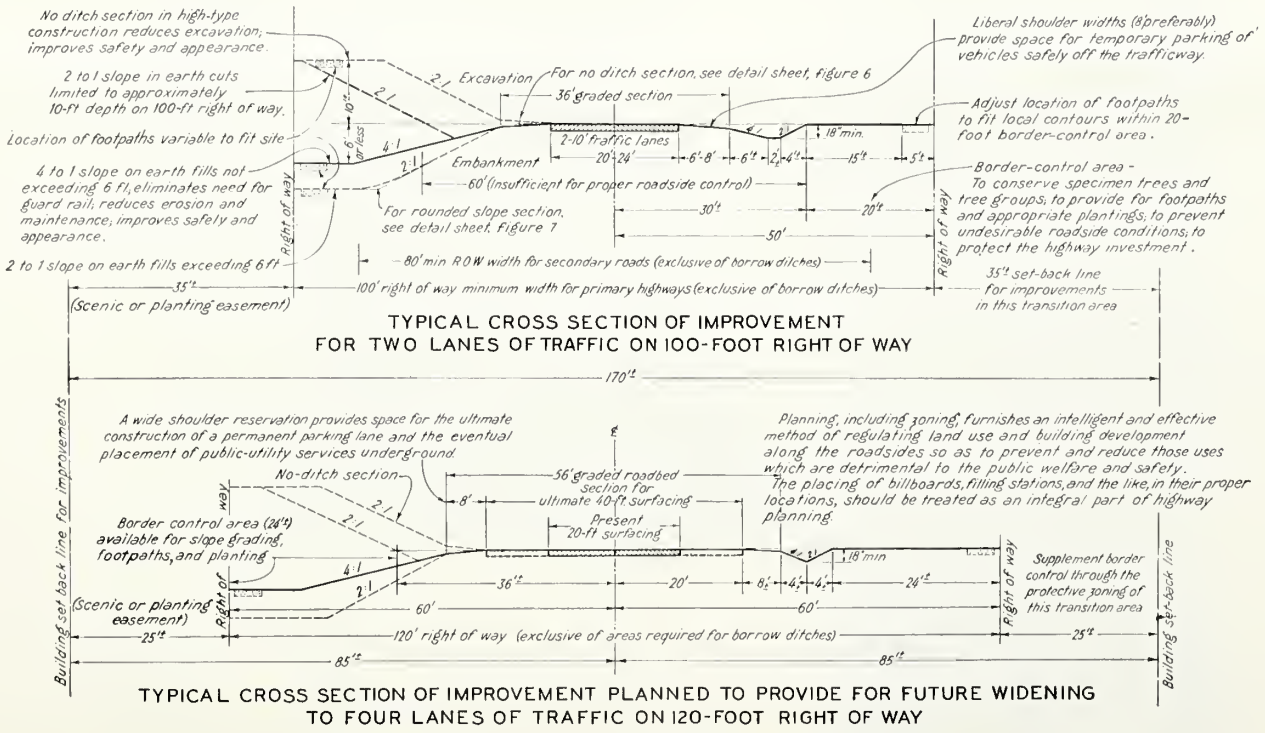
MODERN HIGHWAY DESIGN
IS A PROBLEM OF BALANCING
THE FUNDAMENTAL ELEMENTS OF CONSTRUCTION
IN ECONOMIC RELATIONSHIP

THE FOUNDATION FOR ROADSIDE IMPROVEMENT IS AN ADEQUATE RIGHT OF WAY

THE POSSIBILITIES OF ROADSIDE IMPROVEMENT ARE ENHANCED AS WIDER RIGHTS OF WAY ARE PROVIDED!

The provision of widths of right of way sufficient for future surface widening where it will be needed, and flexibility of treatment in roadside development permits improvement to be economically planned so that all the work will fit harmoniously in the project as originally completed, and as it may be developed to meet future traffic needs.


No ditch section in high-type construction reduces excavation, improves safety and appearance.
2 to 1 slope in earth cuts limited to approximately 10-ft depth on 100-ft right of way.
Location of footpaths variable to fit site
4 to 1 slope on earth fills not exceeding 6 ft, eliminates need for guard rail; reduces erosion and maintenance; improves safety and appearance.
2 to 1 slope on earth fills exceeding 6 ft
Excavation
Embankment
For no ditch section, see detail sheet, figure 6
36' graded section
2-10' traffic lanes
20'-24'
60' (insufficient for proper roadside control)
For rounded slope section, see detail sheet, figure 7
Liberal shoulder widths (8' preferably) provide space for temporary parking of vehicles safely off the trafficway.
Adjust location of footpaths to fit local contours within 20-foot border-control area.
Border-control area - To conserve specimen trees and tree groups, to provide for footpaths and appropriate plantings, to prevent undesirable roadside conditions, to protect the highway investment.
30'
20'
50'
80' min. R.O.W. width for secondary roads (exclusive of borrow ditches)
100' right of way minimum width for primary highways (exclusive of borrow ditches)
35' set-back line for improvements in this transition area
(Scenic or planting easement)
Right of way
TYPICAL CROSS SECTION OF IMPROVEMENT
FOR TWO LANES OF TRAFFIC ON 100-FOOT RIGHT OF WAY
170'
A wide shoulder reservation provides space for the ultimate construction of a permanent parking lane and the eventual placement of public-utility services underground.
No-ditch section
56' graded roadbed section for ultimate 40-ft surfacing
Present 20-ft surfacing
Border control area (24') available for slope grading, footpaths, and planting
Planning, including zoning, furnishes an intelligent and effective method of regulating land use and building development along the roadsides so as to prevent and reduce those uses which are detrimental to the public welfare and safety. The placing of billboards, filling stations, and the like, in their proper locations, should be treated as an integral part of highway planning.
Supplement border control through the protective zoning of this transition area
Building set-back line for improvements
Building set-back line
36'
20'
24'
60'
25'
120' right of way (exclusive of areas required for borrow ditches)
85'
TYPICAL CROSS SECTION OF IMPROVEMENT PLANNED TO PROVIDE FOR FUTURE WIDENING
TO FOUR LANES OF TRAFFIC ON 120-FOOT RIGHT OF WAY

Note:- Figures are approximate estimates and do not include bridges or major structures of 20 feet or more span.

Cost of adequate right of way represents only a relatively small portion (one twentieth) of the total highway investment

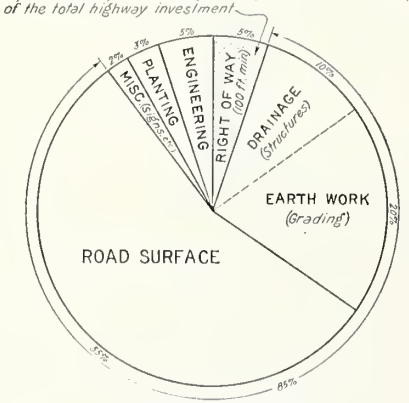
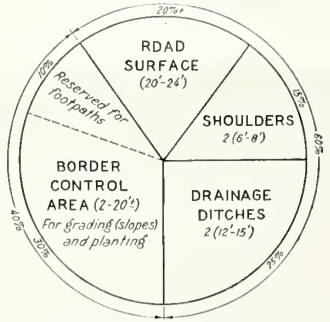
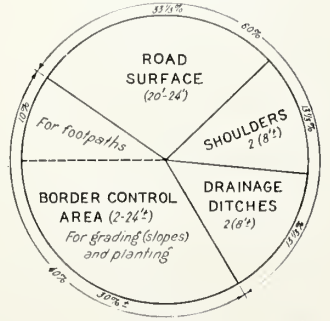


CHART SHOWING RELATIVE DISTRIBUTION OF COSTS FOR AVERAGE CONSTRUCTION ON PRIMARY HIGHWAYS

CHARTS SHOWING APPROXIMATE DISTRIBUTION OF RIGHT-OF-WAY AREAS



100-FOOT RIGHT-OF-WAY SECTION FOR TWO-LANE HIGHWAY



120-FOOT RIGHT-OF-WAY SECTION FOR FOUR-LANE HIGHWAY

J.G.H

FIGURE 2.—TYPICAL CROSS SECTIONS SHOWING DESIRABLE WIDTHS OF RIGHT-OF-WAY.

NATURAL GROWTH FURNISHED THE NEEDED MATERIAL ON THIS SECTION OF HIGHWAY BUILT ON THE LOCATION OF AN ABANDONED CAR LINE. THE ARROW POINTS TO THE SAME TREE IN EACH OF THE PICTURES. AT *B* DRAINAGE PIPE IS BEING PLACED TO AVOID THE NECESSITY OF AN UNSIGHTLY DITCH. IN *C* THE TREE LEANING OVER THE ROADWAY AT THE RIGHT GIVES A PLEASING TOUCH. COMPARE THIS EFFECT WITH THE MECHANICAL PRECISION OF THE PICTURE ON PAGE 17.

ADEQUATE RIGHT-OF-WAY ESSENTIAL

Rights-of-way previously obtained for the main highways have, in general, been much too narrow. A general raising of right-of-way standards is required. Future traffic needs on each highway should be considered, particularly with regard to the probability of future surface widening. The right-of-way width provided should be sufficient to accommodate the future surface width and a landscaped area safely beyond the space required for any future widening. Figure 2 shows possible plans of development on a permanent basis. Narrow rights-of-way have been responsible for high costs of surface widening and often have made landscaping impossible. Such mistakes should be avoided in the future.

Rights-of-way can be purchased now at prices lower than will obtain in the future, according to all indications. On main highways a right-of-way not less than 150 feet wide seems desirable to meet probable future requirements. It may not always be practicable to obtain so great a width, because of buildings or improvements of a substantial character along the road, but whenever practicable, it will be desirable to do so. In certain places considerably greater width may be desirable, especially where there is opportunity for a particularly effective landscape development, such as the preservation of a natural grove of trees, or where it is desired to plant screening material to hide an unsightly area.

Figure 3 may be used to determine the cost per mile of right-of-way of various widths and costs per acre. This figure also shows relations between costs of right-of-way and average costs of low-type and high-type highway construction.

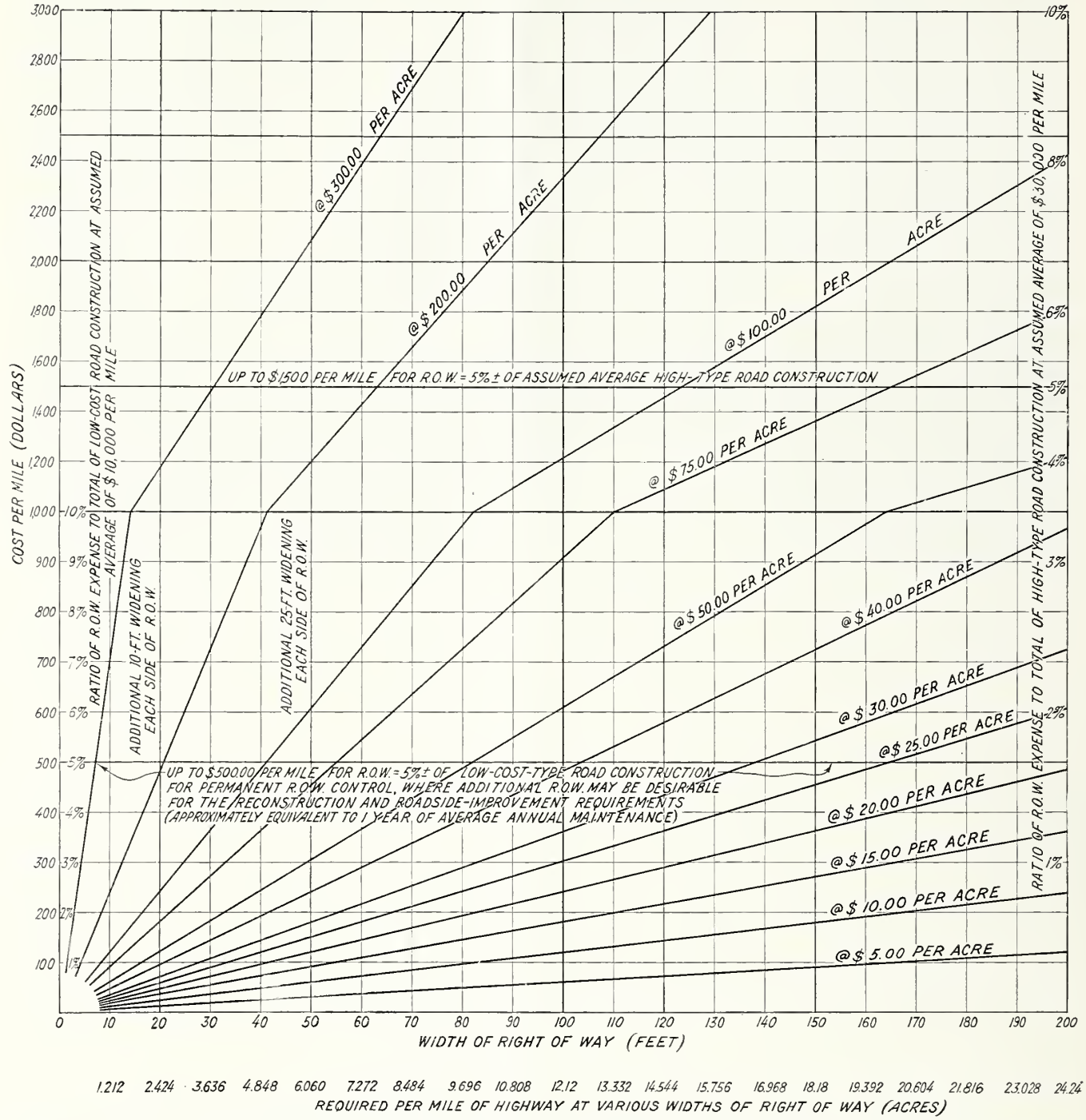
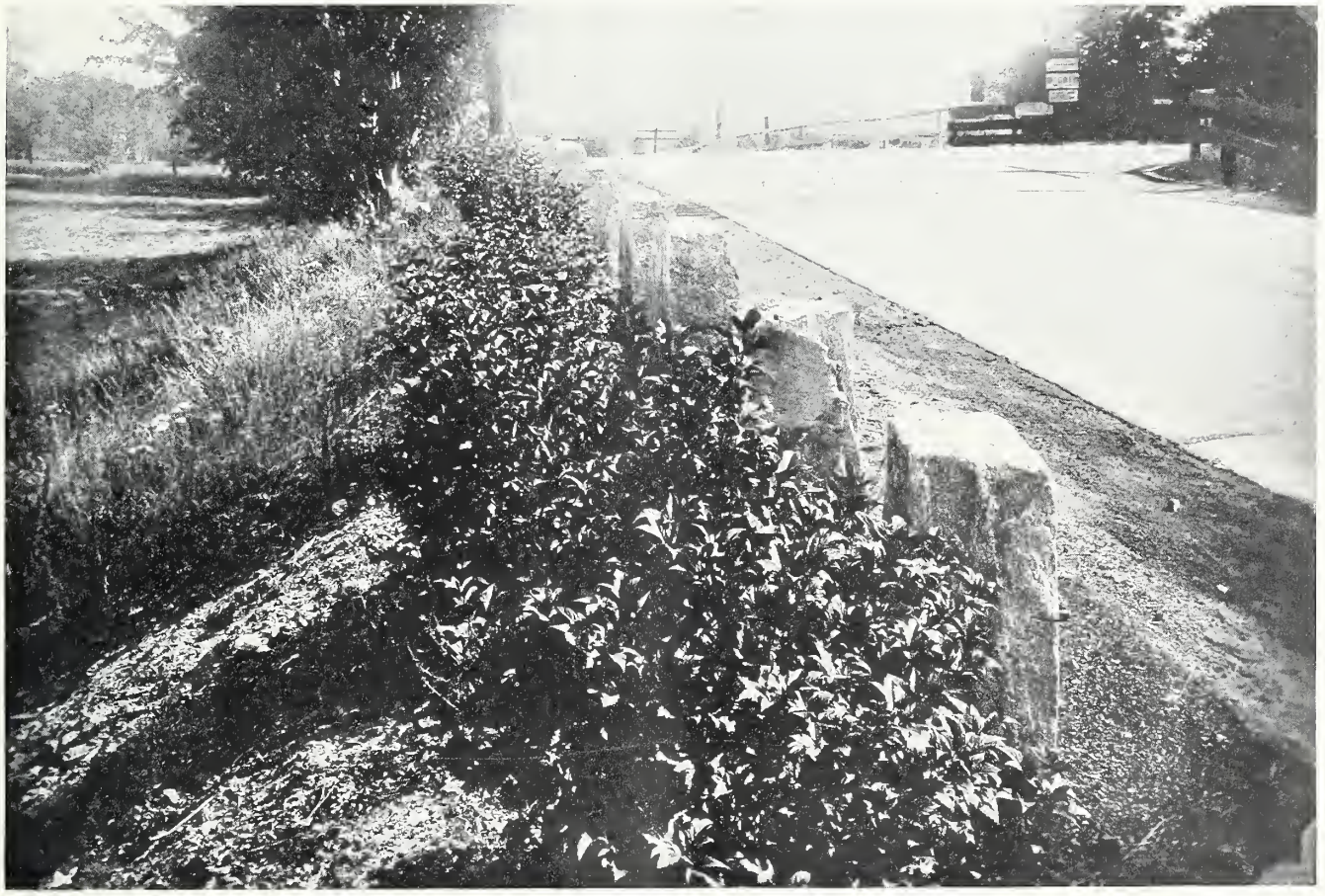

COST PER MILE (DOLLARS)
WIDTH OF RIGHT OF WAY (FEET)
REQUIRED PER MILE OF HIGHWAY AT VARIOUS WIDTHS OF RIGHT OF WAY (ACRES)
RATIO OF R.O.W. EXPENSE TO TOTAL OF LOW-COST ROAD CONSTRUCTION AT ASSUMED AVERAGE OF $10,000 PER MILE
RATIO OF R.O.W. EXPENSE TO TOTAL OF HIGH-TYPE ROAD CONSTRUCTION AT ASSUMED AVERAGE OF $30,000 PER MILE
ADDITIONAL 10-FT. WIDENING EACH SIDE OF R.O.W.
ADDITIONAL 25-FT. WIDENING EACH SIDE OF R.O.W.
@ $300.00 PER ACRE
@ $200.00 PER ACRE
@ $100.00 PER ACRE
@ $75.00 PER ACRE
@ $50.00 PER ACRE
@ $40.00 PER ACRE
@ $30.00 PER ACRE
@ $25.00 PER ACRE
@ $20.00 PER ACRE
@ $15.00 PER ACRE
@ $10.00 PER ACRE
@ $5.00 PER ACRE
UP TO $1,500 PER MILE FOR R.O.W. = 5% ± OF ASSUMED AVERAGE HIGH-TYPE ROAD CONSTRUCTION
UP TO $500.00 PER MILE FOR R.O.W. = 5% ± OF LOW-COST-TYPE ROAD CONSTRUCTION FOR PERMANENT R.O.W. CONTROL, WHERE ADDITIONAL R.O.W. MAY BE DESIRABLE FOR THE RECONSTRUCTION AND ROADSIDE-IMPROVEMENT REQUIREMENTS (APPROXIMATELY EQUIVALENT TO 1 YEAR OF AVERAGE ANNUAL MAINTENANCE)

FIGURE 3.—CHART FOR DETERMINING COST PER MILE OF RIGHT-OF-WAY OF VARIOUS WIDTHS AND COSTS PER ACRE AND RELATION BETWEEN COST OF RIGHT-OF-WAY AND COST OF CONSTRUCTION OF AVERAGE LOW-TYPE AND HIGH-TYPE SURFACES.

SELECTION AND LENGTH OF PROJECTS

Roadside-improvement projects may vary considerably in length and may involve both roads to be constructed and roads previously improved. In the work administered by the Bureau of Public Roads it is desired that no project be less than 1 mile in length. Some projects may extend for 10 or 15 miles, but it is expected that projects will average about 5 miles in length. A reasonable length is necessary for economy in design and supervision and for effectiveness in results.

In making a beginning in this work it is desirable that projects be located where they will be seen and enjoyed by the greatest number of people and serve as demonstrations of the possibilities of improvement. Main highways near large cities are therefore the most preferable locations.



SOFTENING THE HARSH LINES OF PROTECTIVE STONES WITH A SIMPLE AND INEXPENSIVE TREATMENT. (PHOTO BY JAMES H. TAYLOR.)

PARTIAL ROADSIDE DEVELOPMENT POSSIBLE

All projects for roadside development need not necessarily consist of a complete development including the final planting. The planning should contemplate a complete development, but immediate work can be limited to grading, advance preparation of the soil, and seeding, the planting of nursery and other stock being deferred till a later time.

IMPROVEMENT DOES NOT HAVE TO BE ON AN INTENSIVE SCALE TO BE WORTH WHILE. THIS ILLUSTRATES THE KIND OF WORK THAT CAN BE DONE BY LOCAL ORGANIZATIONS.

GRAY BIRCH WITH BRUSH AND LOWER LIMBS REMOVED FOR TRUNK EMPHASIS. A SIMPLE AND INEXPENSIVE TREATMENT. (PHOTO BY JAMES H. TAYLOR.)

COST OF IMPROVEMENT

Adequate roadside improvement can be accomplished without material increase in highway costs. Figure 2 shows the percentages of land area occupied by the road surface, shoulders, drainage ditches, and planting. Figure 4 shows the relative costs of the various items entering into an average surfaced highway.

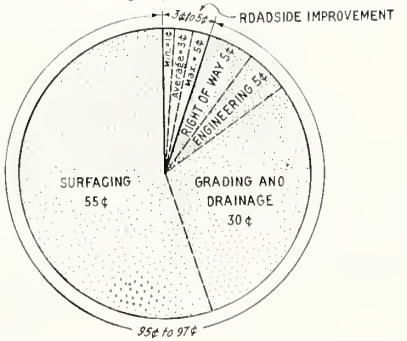
Of every dollar expended on such a road, 30 cents would be spent for grading and drainage, 55 cents for surfacing, 5 cents for engineering, 5 cents for right-of-way, and from 3 to 5 cents for roadside improvement.

It is of particular interest at the present time that approximately two thirds of the roadside-improvement expenditure goes directly to labor on the job, while a large part of the remaining third goes to labor employed in growing and supplying planting material.

Contrary to a somewhat general belief, the cost of roadside improvement is not absorbed largely in the purchase and planting of trees and shrubs. Of the average dollar expended, about 10 cents will be necessary for detailed planning and supervision, 15 cents will be expended for conservation of existing growth, 32 cents will be required to prepare the ground for seeding and planting, 10 cents will be required for contingencies, such as watering during droughts, and only 33 cents will be spent for the purchase of plants and seeds and the actual planting.

A, FINE SPECIMEN TREE SAVED TO BEAUTIFY THE ROAD. IN *B* GROUND COVER PLANTS ARE BECOMING ESTABLISHED ON THE AREA AT THE RIGHT AND WILL MAKE A MASS OF GREEN THROUGHOUT THE YEAR.

Approximate cost of conservation development with appropriate planting represents only a relatively small portion of the total highway investment.



OUT OF EVERY HIGHWAY DOLLAR EXPENDED FOR A COMPLETE AND BALANCED IMPROVEMENT:

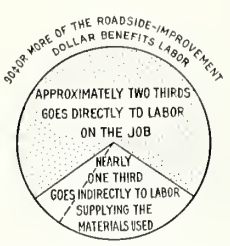
5¢ (or less) is the relative average cost of comprehensive roadside improvement
95¢ (or more) is for rights of way, supervision, grading, drainage, and surfacing.
$1.00 Total

The average expenditure required for comprehensive roadside improvement varies from 3 percent to 5 percent of the total cost per mile of a complete highway.
Individual estimates may be as low as 1 percent where the existing conditions are highly favorable.
Approximately 5 percent is required where the local conditions are unusual or difficult.
3 percent represents the general average for a comprehensive program of roadside planting and development

Roadside-improvement estimates for typical demonstration projects, on this assumed basis, average as follows:
Primary highway construction — Comprehensive roadside improvement

Total cost per mile = 100%		Average cost per mile = 3%
$15,000		$ 450
25,000	(estimated average cost)	750
35,000		1,050

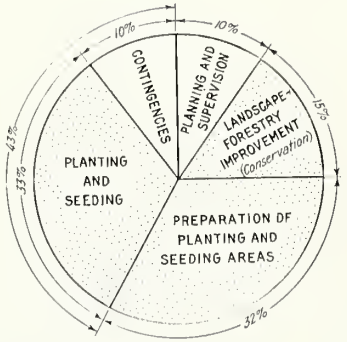
One 10-mile unit of roadside improvement at the estimated average cost of $ 750 per mile ($ 7,500) is approximately equivalent to the cost of 1 mile of low-type highway construction ($ 7,500)
At least three typical 10-mile units, or a total of more than 30 miles of roadside improvement is approximately equivalent to the cost of 1 mile of high-type highway construction ($ 25,000).


90¢ OR MORE OF THE ROADSIDE-IMPROVEMENT DOLLAR BENEFITS LABOR
APPROXIMATELY TWO THIRDS GOES DIRECTLY TO LABOR ON THE JOB
NEARLY ONE THIRD GOES INDIRECTLY TO LABOR SUPPLYING THE MATERIALS USED

RATIO OF DIRECT AND INDIRECT LABOR EMPLOYMENT RESULTING FROM ROADSIDE-IMPROVEMENT EXPENDITURES

On roadside-improvement projects:
65¢ to 70¢ of every dollar is spent directly on the job for the effective employment of labor and
25¢ to 30¢ is spent for the benefit of labor employment indirectly through the purchase of plants and incidental materials.
90¢ or more = Total labor benefit for such expenditures.

Roadside improvement is a most effective means of spreading work where labor employment is most needed



OUT OF EVERY DOLLAR EXPENDED FOR A TYPICAL COMPREHENSIVE ROADSIDE IMPROVEMENT

10¢ is the approximate cost of detailed planning and competent supervision.
15¢ is required for basic conservation work (landscape-forestry improvement)
32¢ is necessary for thorough advance preparation of planting and seeding areas.
33¢ is the average amount expended on the actual work of planting and seeding
10¢ is needed for contingency operations due to abnormal weather conditions.
$1.00 Total

Roadside improvement affords unusual opportunities for the constructive employment of unskilled labor directly on the job in the locality of the work
Two thirds to three fourths of the cost of such work is for the planning and thorough preparation of the area in advance of planting, for conservation work and for the final work of planting and seeding operations (direct employment).
Only one fourth to one third of the total cost of the work is required for plant materials, tools, and incidental equipment (indirect employment)
The inclusion of roadside-improvement work as a definite and tangible part of highway construction, therefore, aids materially in the better balancing of the highway program to serve the employment needs of populated centers.

J.G.H.

FIGURE 4.—DISTRIBUTION OF COSTS OF ROADSIDE IMPROVEMENT. THE WORK OF ROADSIDE IMPROVEMENT IS LARGELY HANDWORK. A WELL-BALANCED PROGRAM OF ROADSIDE IMPROVEMENT UTILIZES UNSKILLED LABOR TO A MAXIMUM DEGREE. MORE THAN 90 PERCENT OF EVERY DOLLAR SPENT FOR THIS KIND OF CONSTRUCTIVE WORK ULTIMATELY ARRIVES IN THE PAY ENVELOP OF LABOR. OF THIS AMOUNT, APPROXIMATELY 65 TO 70 PERCENT IS A DIRECT BENEFIT TO LOCAL LABOR AND 25 TO 30 PERCENT IS A BENEFIT TO OTHER LABOR INDIRECTLY ENGAGED IN SUPPLYING PLANT MATERIALS

A NEGLECTED OPPORTUNITY. CUTTING HAS BEEN CARRIED TO THE RIGHT-OF-WAY LINE. THINNING OF TREES WITH THE WOODS COMING OUT TO THE ROAD IN AN IRREGULAR LINE WOULD GREATLY IMPROVE THIS NATURALLY BEAUTIFUL SCENE. PLANTING IS NOT NEEDED HERE.

PREPARATION OF PLANS

On a roadside-improvement project the landscape architect is concerned with two sets of plans: Those covering the general engineering features of the project prepared by the engineering staff, and his own set of plans covering planting and other features.

In planning new road construction, preliminary studies should be made jointly by the engineer and landscape architect to consider desirable adjustments in location and widths of right-of-way. This collaboration should continue throughout the construction of the road. It is their common problem to fit the highway into harmonious relationship with the surrounding countryside.

Much of the natural growth along the highway should be conserved. Frequently a slight change in location will save a particularly fine tree or clump of trees. Such desirable changes, suggested by the landscape architect, may generally be made by the engineer without increase of cost or sacrifice of any essential engineering or transportation requirement.

Much of the foundation work of landscaping can be included in the engineer's plans and specifications and performed as a part of the main contract. Such a procedure is decidedly more economical than handling the landscaping under a separate contract.

Hard and fast rules for landscape grading are not advisable, as varying local conditions require varying treatment. General rules, however, may be prepared by the landscape architect, and these may be applied by the engineering organization to the varying conditions encountered.

The object should be to make the new surfaces of cuts and fills flow into the natural ground contours with as little break in grade as possible. It is not necessary that the side ditches be always parallel to the roadway or have uniformly sloping banks. They can meander sometimes to miss trees or to follow the curve of a hillside. Ditch banks in favorable soils can be rounded or sloped so as to be almost unnoticed.

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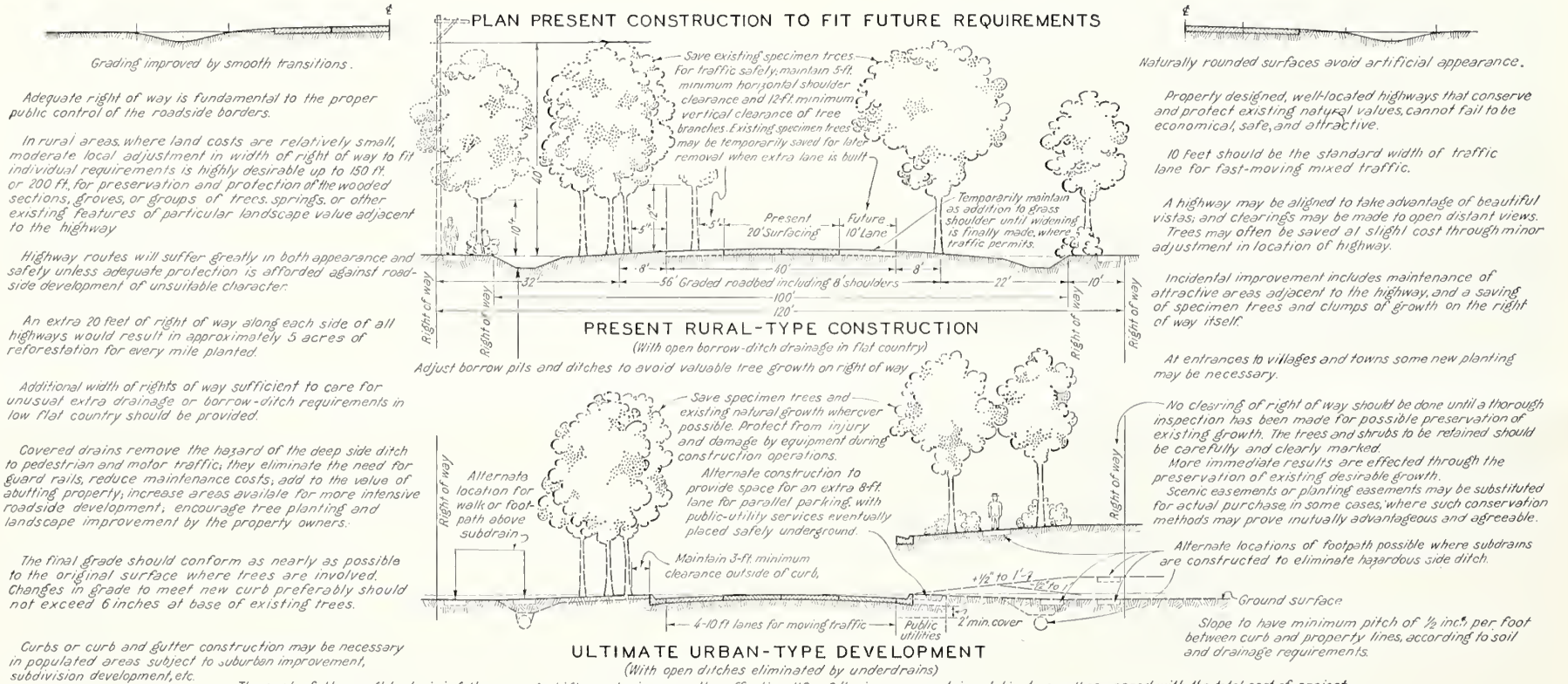

PLAN PRESENT CONSTRUCTION TO FIT FUTURE REQUIREMENTS
Grading improved by smooth transitions.
Adequate right of way is fundamental to the proper public control of the roadside borders.
In rural areas, where land costs are relatively small, moderate local adjustment in width of right of way to fit individual requirements is highly desirable up to 150 ft. or 200 ft., for preservation and protection of the wooded sections, groves, or groups of trees, springs, or other existing features of particular landscape value adjacent to the highway.
Highway routes will suffer greatly in both appearance and safety unless adequate protection is afforded against roadside development of unsuitable character.
An extra 20 feet of right of way along each side of all highways would result in approximately 5 acres of reforestation for every mile planted.
Additional width of rights of way sufficient to care for unusual extra drainage or borrow-ditch requirements in low flat country should be provided.
Covered drains remove the hazard of the deep side ditch to pedestrian and motor traffic, they eliminate the need for guard rails, reduce maintenance costs; add to the value of abutting property, increase areas available for more intensive roadside development; encourage tree planting and landscape improvement by the property owners.
The final grade should conform as nearly as possible to the original surface where trees are involved. Changes in grade to meet new curb preferably should not exceed 6 inches at base of existing trees.
Curbs or curb and gutter construction may be necessary in populated areas subject to suburban improvement, subdivision development, etc.
Save existing specimen trees. For traffic safety, maintain 5-ft. minimum horizontal shoulder clearance and 12-ft. minimum vertical clearance of tree branches. Existing specimen trees may be temporarily saved for later removal when extra lane is built.
Present 20' Surfacing
Future 10' Lane
Temporarily maintain as addition to grass shoulder until widening is finally made, where traffic permits.
32'
8'
40'
56' Graded roadbed including 8' shoulders
8'
22'
10'
100'
120'
Right of way
PRESENT RURAL-TYPE CONSTRUCTION
(With open borrow-ditch drainage in flat country)
Adjust borrow pits and ditches to avoid valuable tree growth on right of way.
Save specimen trees and existing natural growth wherever possible. Protect from injury and damage by equipment during construction operations.
Alternate location for walk or foot-path above subdrain.
Alternate construction to provide space for an extra 8-ft. lane for parallel parking, with public-utility services eventually placed safely underground.
Maintain 3-ft. minimum clearance outside of curb.
+½" to 1'-2"
2" to 1'
Ground surface
4-10 ft. lanes for moving traffic
Public utilities
1-2' min. cover
ULTIMATE URBAN-TYPE DEVELOPMENT
(With open ditches eliminated by underdrains)
Naturally rounded surfaces avoid artificial appearance.
Properly designed, well-located highways that conserve and protect existing natural values, cannot fail to be economical, safe, and attractive.
10 feet should be the standard width of traffic lane for fast-moving mixed traffic.
A highway may be aligned to take advantage of beautiful vistas; and clearings may be made to open distant views. Trees may often be saved at slight cost through minor adjustment in location of highway.
Incidental improvement includes maintenance of attractive areas adjacent to the highway, and a saving of specimen trees and clumps of growth on the right of way itself.
At entrances to villages and towns some new planting may be necessary.
No clearing of right of way should be done until a thorough inspection has been made for possible preservation of existing growth. The trees and shrubs to be retained should be carefully and clearly marked.
More immediate results are effected through the preservation of existing desirable growth.
Scenic easements or planting easements may be substituted for actual purchase, in some cases, where such conservation methods may prove mutually advantageous and agreeable.
Alternate locations of footpath possible where subdrains are constructed to eliminate hazardous side ditch.
Slope to have minimum pitch of ½ inch per foot between curb and property lines, according to soil and drainage requirements.
The cost of thoroughly draining the average highway to increase the effective life of the improvement is relatively small compared with the total cost of project. By properly planning for the future with a complete and definite cross section as a final objective for each class of highway, the improvement will eventually be developed into a systematic and orderly highway, producing the maximum in public service at the lowest possible cost.
J.G.H.

FIGURE 5.—CROSS SECTIONS SHOWING A TYPICAL PLAN FOR PRESENT AND FUTURE DEVELOPMENT. PROPER LOCATION AND DESIGN OF A HIGHWAY IS THE PHYSICAL FOUNDATION FOR A CONSTRUCTIVE IMPROVEMENT. CONSERVATION OF EXISTING NATURAL SCENIC RESOURCES IS THE KEY TO A COMPLETE HIGHWAY DEVELOPMENT. PROTECTIVE BORDER CONTROL IS VITAL TO INSURE AN ORDERLY AND CLEAN ROADSIDE APPEARANCE. APPROPRIATE PLANTING IS THE FINAL PHASE OF A LOGICALLY DEVELOPED, COMPREHENSIVE ROADSIDE-IMPROVEMENT PROGRAM. A DEFINITE PLAN AND POLICY SHOULD BE ADOPTED AND CONTINUOUSLY FOLLOWED TO PRODUCE THE GREATEST SERVICE AT THE LOWEST COST.

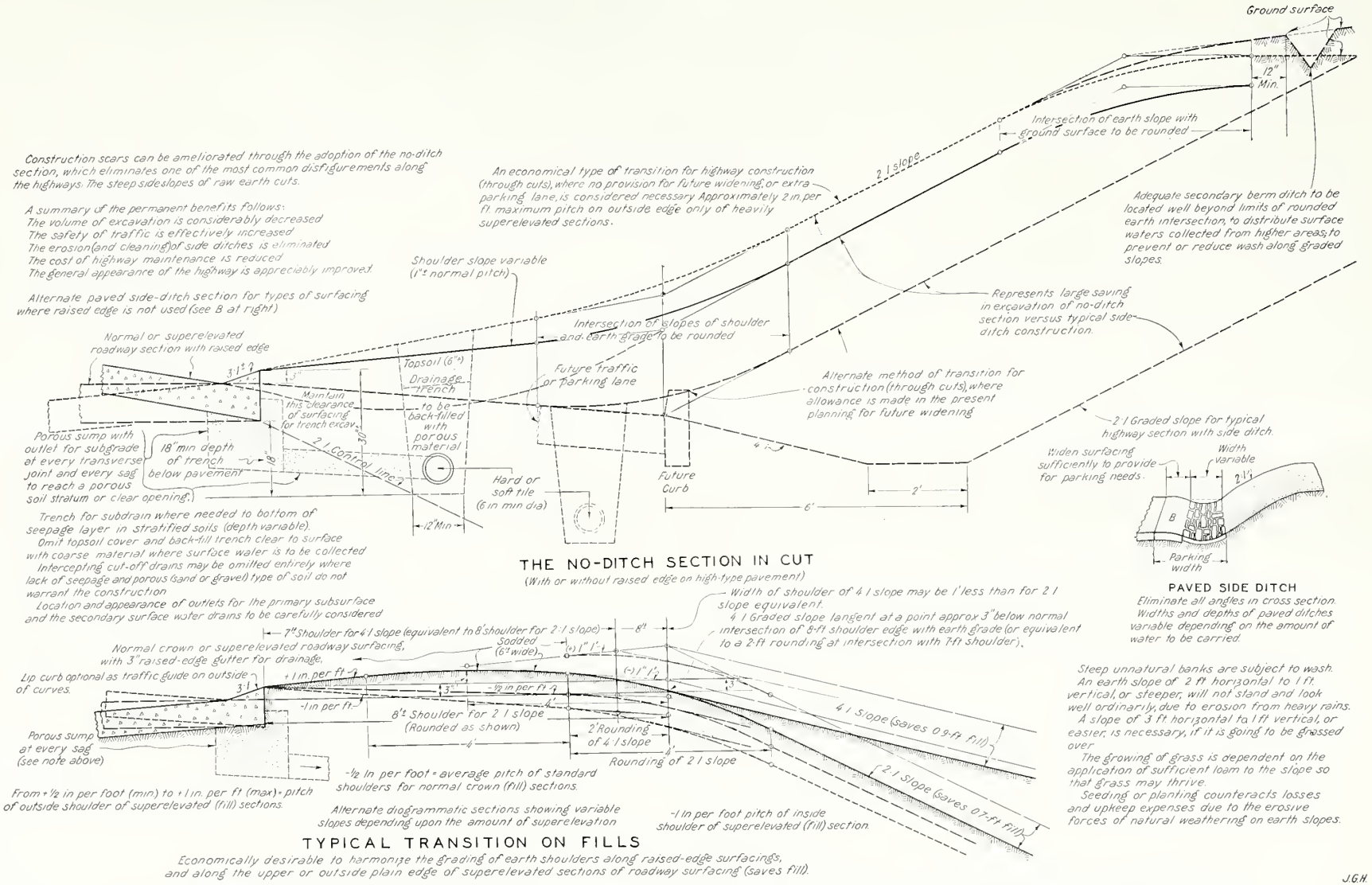

Construction scars can be ameliorated through the adoption of the no-ditch section, which eliminates one of the most common disfigurements along the highways. The steep sideslopes of raw earth cuts.
A summary of the permanent benefits follows:
The volume of excavation is considerably decreased
The safety of traffic is effectively increased
The erosion (and cleaning) of side ditches is eliminated
The cost of highway maintenance is reduced
The general appearance of the highway is appreciably improved.
Alternate paved side-ditch section for types of surfacing where raised edge is not used (see B at right)
An economical type of transition for highway construction (through cuts), where no provision for future widening, or extra parking lane, is considered necessary. Approximately 2 in. per ft. maximum pitch on outside edge only of heavily superelevated sections.
Ground surface
12" Min.
Intersection of earth slope with ground surface to be rounded
2:1 slope
Adequate secondary berm ditch to be located well beyond limits of rounded earth intersection, to distribute surface waters collected from higher areas; to prevent or reduce wash along graded slopes.
Shoulder slope variable (1" ± normal pitch)
Represents large saving in excavation of no-ditch section versus typical side-ditch construction.
Intersection of slopes of shoulder and earth grade to be rounded
Normal or superelevated roadway section with raised edge
3:1 ± ?
Topsoil (6" ±)
Drainage trench
Maintain this clearance of surfacing for trench excav.
to be back-filled with porous material
Future traffic or parking lane
Alternate method of transition for construction (through cuts), where allowance is made in the present planning for future widening
2:1 Graded slope for typical highway section with side ditch.
Porous sump with outlet for subgrade at every transverse joint and every sag to reach a porous soil stratum or clear opening.
18" min depth of trench below pavement
2:1 Control line
Hard or soft tile (6 in min dia)
Future Curb
4'
2'
6'
12" Min.
Widen surfacing sufficiently to provide for parking needs.
Width variable
2:1
B
Parking width
Trench for subdrain where needed to bottom of seepage layer in stratified soils (depth variable).
Omit topsoil cover and back-fill trench clear to surface with coarse material where surface water is to be collected
Intercepting cut-off drains may be omitted entirely where lack of seepage and porous (sand or gravel) type of soil do not warrant the construction.
Location and appearance of outlets for the primary subsurface and the secondary surface water drains to be carefully considered
THE NO-DITCH SECTION IN CUT
(With or without raised edge on high-type pavement)
PAVED SIDE DITCH
Eliminate all angles in cross section. Widths and depths of paved ditches variable depending on the amount of water to be carried.
Width of shoulder of 4:1 slope may be 1' less than for 2:1 slope equivalent.
4:1 Graded slope tangent at a point approx 3" below normal intersection of 8-ft shoulder edge with earth grade (or equivalent to a 2-ft rounding at intersection with 7-ft shoulder).
7" Shoulder for 4:1 slope (equivalent to 8' shoulder for 2:1 slope)
8'
Sodded (6" wide)
(+) 1" 1'
(-) 1" 1'
Normal crown or superelevated roadway surfacing, with 3" raised-edge gutter for drainage;
Lip curb optional as traffic guide on outside of curves.
3:1
+1 in. per ft
-1 in per ft
-½ in per ft
3'
4'
8' Shoulder for 2:1 slope (Rounded as shown)
2' Rounding of 4:1 slope
Rounding of 2:1 slope
4:1 Slope (saves 0.9-ft. fill)
2:1 Slope (saves 0.7-ft fill)
Porous sump at every sag (see note above)
From +½ in per foot (min) to +1 in. per ft (max) + pitch of outside shoulder of superelevated (fill) sections.
-½ in per foot = average pitch of standard shoulders for normal crown (fill) sections.
Alternate diagrammatic sections showing variable slopes depending upon the amount of superelevation
-1 in per foot pitch of inside shoulder of superelevated (fill) section.
TYPICAL TRANSITION ON FILLS
Economically desirable to harmonize the grading of earth shoulders along raised-edge surfacings, and along the upper or outside plain edge of superelevated sections of roadway surfacing (saves fill).
Steep unnatural banks are subject to wash.
An earth slope of 2 ft horizontal to 1 ft. vertical, or steeper, will not stand and look well ordinarily, due to erosion from heavy rains.
A slope of 3 ft. horizontal to 1 ft vertical, or easier, is necessary, if it is going to be grassed over.
The growing of grass is dependent on the application of sufficient loam to the slope so that grass may thrive.
Seeding or planting counteracts losses and upkeep expenses due to the erosive forces of natural weathering on earth slopes.
J.G.H.

FIGURE 6.—RECOMMENDED PRACTICE IN ROUNDING SLOPES AND DISPOSING OF SURFACE WATER.

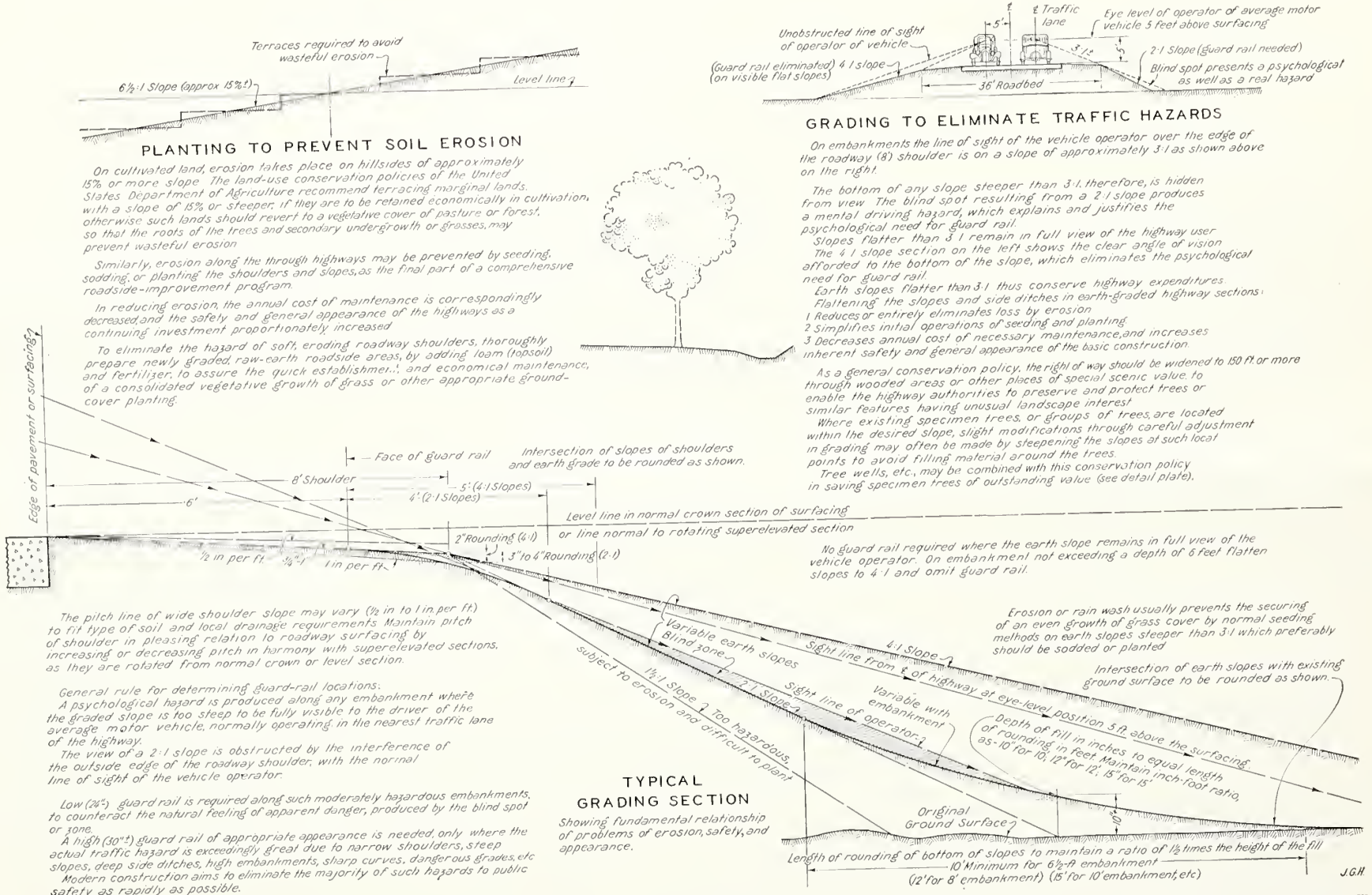

Terraces required to avoid wasteful erosion
6½:1 Slope (approx 15%±)
Level line
PLANTING TO PREVENT SOIL EROSION
On cultivated land, erosion takes place on hillsides of approximately 15% or more slope. The land-use conservation policies of the United States Department of Agriculture recommend terracing marginal lands, with a slope of 15% or steeper, if they are to be retained economically in cultivation, otherwise such lands should revert to a vegetative cover of pasture or forest, so that the roots of the trees and secondary undergrowth or grasses, may prevent wasteful erosion.
Similarly, erosion along the through highways may be prevented by seeding, sodding, or planting the shoulders and slopes, as the final part of a comprehensive roadside-improvement program.
In reducing erosion, the annual cost of maintenance is correspondingly decreased, and the safety and general appearance of the highways as a continuing investment proportionately increased.
To eliminate the hazard of soft, eroding roadway shoulders, thoroughly prepare newly graded, raw-earth roadside areas, by adding loam (topsoil) and fertilizer, to assure the quick establishment, and economical maintenance, of a consolidated vegetative growth of grass or other appropriate ground-cover planting.
℄ Traffic lane
5'
Eye level of operator of average motor vehicle 5 feet above surfacing
Unobstructed line of sight of operator of vehicle
3'-1½"
5'
2:1 Slope (guard rail needed)
(Guard rail eliminated) 4:1 slope (on visible flat slopes)
Blind spot presents a psychological as well as a real hazard
36' Roadbed
GRADING TO ELIMINATE TRAFFIC HAZARDS
On embankments the line of sight of the vehicle operator over the edge of the roadway (8') shoulder is on a slope of approximately 3:1 as shown above on the right.
The bottom of any slope steeper than 3:1, therefore, is hidden from view. The blind spot resulting from a 2:1 slope produces a mental driving hazard, which explains and justifies the psychological need for guard rail.
Slopes flatter than 3:1 remain in full view of the highway user.
The 4:1 slope section on the left shows the clear angle of vision afforded to the bottom of the slope, which eliminates the psychological need for guard rail.
Earth slopes flatter than 3:1 thus conserve highway expenditures.
Flattening the slopes and side ditches in earth-graded highway sections:
1 Reduces or entirely eliminates loss by erosion.
2 Simplifies initial operations of seeding and planting.
3 Decreases annual cost of necessary maintenance, and increases inherent safety and general appearance of the basic construction.
As a general conservation policy, the right of way should be widened to 150 ft. or more through wooded areas or other places of special scenic value, to enable the highway authorities to preserve and protect trees or similar features having unusual landscape interest.
Where existing specimen trees, or groups of trees, are located within the desired slope, slight modifications through careful adjustment in grading may often be made by steepening the slopes at such local points to avoid filling material around the trees.
Tree wells, etc., may be combined with this conservation policy in saving specimen trees of outstanding value (see detail plate).
Edge of pavement or surfacing
Face of guard rail
Intersection of slopes of shoulders and earth grade to be rounded as shown.
8' Shoulder
6'
5':(4:1 Slopes)
4':(2:1 Slopes)
Level line in normal crown section of surfacing
or line normal to rotating superelevated section
2" Rounding (4:1)
3" to 4" Rounding (2:1)
½ in per ft.
¼" "
1 in per ft.
No guard rail required where the earth slope remains in full view of the vehicle operator. On embankment not exceeding a depth of 6 feet flatten slopes to 4:1 and omit guard rail.
The pitch line of wide shoulder slope may vary (½ in to 1 in per ft.) to fit type of soil and local drainage requirements. Maintain pitch of shoulder in pleasing relation to roadway surfacing by increasing or decreasing pitch in harmony with superelevated sections, as they are rotated from normal crown or level section.
General rule for determining guard-rail locations:
A psychological hazard is produced along any embankment where the graded slope is too steep to be fully visible to the driver of the average motor vehicle, normally operating, in the nearest traffic lane of the highway.
The view of a 2:1 slope is obstructed by the interference of the outside edge of the roadway shoulder, with the normal line of sight of the vehicle operator.
Low (24") guard rail is required along such moderately hazardous embankments, to counteract the natural feeling of apparent danger, produced by the blind spot or zone.
A high (30" ±) guard rail of appropriate appearance is needed, only where the actual traffic hazard is exceedingly great due to narrow shoulders, steep slopes, deep side ditches, high embankments, sharp curves, dangerous grades, etc.
Modern construction aims to eliminate the majority of such hazards to public safety as rapidly as possible.
TYPICAL GRADING SECTION
Showing fundamental relationship of problems of erosion, safety, and appearance.
Variable earth slopes
Blind zone
Sight line from ℄ of highway at eye-level position 5 ft. above the surfacing
4:1 Slope
Sight line of operator
2:1 Slope
Variable with embankment
Depth of fill in inches to equal length of rounding in feet. Maintain inch-foot ratio, as 10" for 10', 12" for 12', 15" for 15'.
1½:1 Slope subject to erosion and difficult to plant
Too hazardous
Erosion or rain wash usually prevents the securing of an even growth of grass cover by normal seeding methods on earth slopes steeper than 3:1 which preferably should be sodded or planted.
Intersection of earth slopes with existing ground surface to be rounded as shown.
Original Ground Surface
Length of rounding of bottom of slopes to maintain a ratio of 1½ times the height of the fill
10' Minimum for 6½-ft embankment
(12' for 8' embankment) (15' for 10' embankment, etc)
J.G.H.

FIGURE 7.—TYPICAL CROSS SECTIONS FOR GRADING DESIGNED TO GIVE GOOD APPEARANCE, MAKE THE HIGHWAY SAFER, AND PREVENT EROSION. THE MODERN HIGHWAY SHOULD BE SO LOCATED AND DESIGNED AS TO PROVIDE FACILITY OF TRAVEL WITH COMFORT AND SAFETY AND AT THE SAME TIME PRESERVE THE NATURAL BEAUTY OF THE SURROUNDINGS. THE VIEWPOINT OF THE DRIVER CONTROLS THE DESIGN.

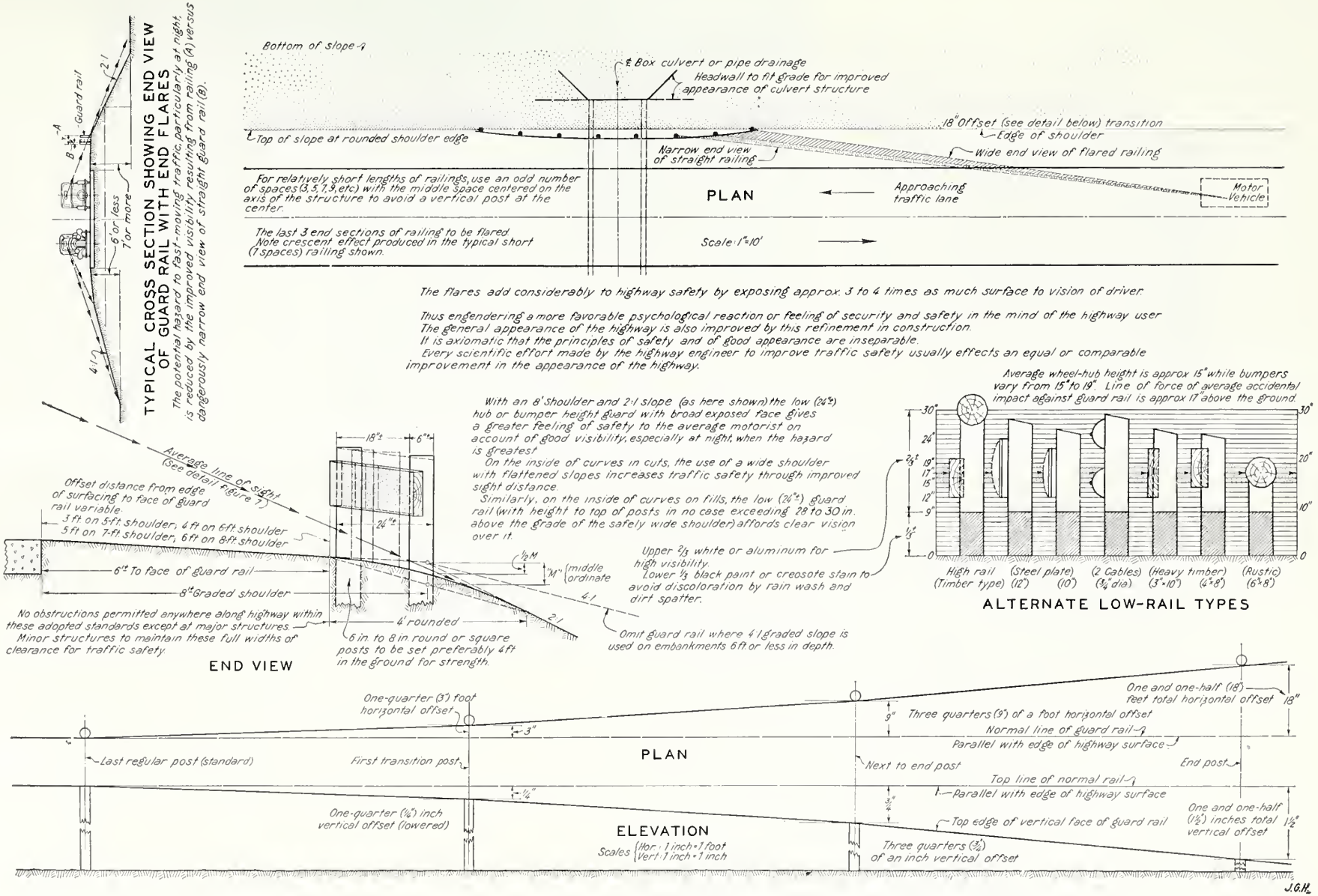

TYPICAL CROSS SECTION SHOWING END VIEW OF GUARD RAIL WITH END FLARES
The potential hazard to fast-moving traffic, particularly at night, is reduced by the improved visibility resulting from railing (A) versus dangerously narrow end view of straight guard rail (B).
Guard rail
A
B
2:1
6' or less
7' or more
4:1
Bottom of slope
℄ Box culvert or pipe drainage
Headwall to fit grade for improved appearance of culvert structure
18" Offset (see detail below) transition
Edge of shoulder
Top of slope at rounded shoulder edge
Narrow end view of straight railing
Wide end view of flared railing
For relatively short lengths of railings, use an odd number of spaces (3, 5, 7, 9, etc) with the middle space centered on the axis of the structure to avoid a vertical post at the center.
PLAN
Approaching traffic lane
Motor Vehicle
The last 3 end sections of railing to be flared. Note crescent effect produced in the typical short (7 spaces) railing shown.
Scale: 1"=10'
The flares add considerably to highway safety by exposing approx. 3 to 4 times as much surface to vision of driver.
Thus engendering a more favorable psychological reaction or feeling of security and safety in the mind of the highway user.
The general appearance of the highway is also improved by this refinement in construction.
It is axiomatic that the principles of safety and of good appearance are inseparable.
Every scientific effort made by the highway engineer to improve traffic safety usually effects an equal or comparable improvement in the appearance of the highway.
Average wheel-hub height is approx 15" while bumpers vary from 15" to 19". Line of force of average accidental impact against guard rail is approx 17" above the ground.
With an 8' shoulder and 2:1 slope (as here shown) the low (24") hub or bumper height guard with broad exposed face gives a greater feeling of safety to the average motorist on account of good visibility, especially at night, when the hazard is greatest.
On the inside of curves in cuts, the use of a wide shoulder with flattened slopes increases traffic safety through improved sight distance.
Similarly, on the inside of curves on fills, the low (24") guard rail (with height to top of posts in no case exceeding 28 to 30 in. above the grade of the safely wide shoulder) affords clear vision over it.
Average line of sight (See detail figure 7)
Offset distance from edge of surfacing to face of guard rail variable.
3 ft on 5-ft. shoulder, 4 ft on 6-ft shoulder
5 ft on 7-ft. shoulder, 6 ft on 8-ft. shoulder
18"±
6"
24"
6" To face of guard rail
8" Graded shoulder
½M
"M" (middle ordinate
4:1
2:1
4' rounded
No obstructions permitted anywhere along highway within these adopted standards except at major structures.
Minor structures to maintain these full widths of clearance for traffic safety.
6 in to 8 in round or square posts to be set preferably 4 ft in the ground for strength.
END VIEW
Omit guard rail where 4:1 graded slope is used on embankments 6 ft or less in depth.
Upper ⅔ white or aluminum for high visibility.
Lower ⅓ black paint or creosote stain to avoid discoloration by rain wash and dirt spatter.
30"
24"
19"
17"
15"
12"
9"
0
20"
10"
High rail (Timber type) (12")
(Steel plate) (10")
(2 Cables) (¾" dia)
(Heavy timber) (3"×10")
(Rustic) (4"×8")
(6"×8")
ALTERNATE LOW-RAIL TYPES
One-quarter (3") foot horizontal offset
3"
Last regular post (standard)
First transition post
PLAN
Next to end post
End post
One and one-half (18") feet total horizontal offset
18"
9"
Three quarters (9") of a foot horizontal offset
Normal line of guard rail
Parallel with edge of highway surface
Top line of normal rail
Parallel with edge of highway surface
1¼"
3"/4
One-quarter (¼") inch vertical offset (lowered)
ELEVATION
Scales {Hor.: 1 inch = 1 foot / Vert.: 1 inch = 1 inch
Top edge of vertical face of guard rail
Three quarters (¾") of an inch vertical offset
One and one-half (1½") inches total vertical offset
1½"
J.G.H.

FIGURE 8.—FLARING OF ENDS OF GUARD RAILS IMPROVES APPEARANCE AND INCREASES SAFETY.

A CLUMP OF TREES SAVED TO BEAUTIFY THE ROAD.

Figures 5, 6, 7, and 8 describe recommended practices which should be incorporated in the general construction plans. Attention is called particularly to the departure from common engineering practice in flattening the slopes of cuts and fills and the transition for cut and fill slopes where they intersect the ground surface.

The plans should provide for removal of the topsoil where excavation is to occur and for storing it at suitable places in piles for later distribution over areas of new grading which are to be seeded or planted. In many cases it will be advisable to indicate the removal and storage of topsoil from areas to be covered by fills.

These are only a few examples of the need for collaboration between the engineer and the landscape architect if the work of roadside improvement is to be conducted with maximum efficiency and effectiveness.

A, PARKING AREA AT THE MOUNT VERNON TERMINAL OF THE GEORGE WASHINGTON MEMORIAL HIGHWAY DURING CONSTRUCTION. *B*, THE AREA SOON AFTER COMPLETION OF PLANTING. NOTE PROTECTIVE FRAMEWORK AROUND TREES DURING CONSTRUCTION. PLANTINGS SCREEN THE MASSES OF PARKED CARS FROM THE VIEW OF VISITORS APPROACHING MOUNT VERNON. PLANTINGS SUCH AS THIS ARE RECOMMENDED ONLY FOR INTENSIVE DEVELOPMENT AT PLACES OF EXCEPTIONAL INTEREST.

STEEP CUT AND FILL SLOPES UNDESIRABLE

The uniformly steep slopes of cuts and fills that have been used in the past are not desirable. They are unsightly and difficult to maintain. At curves a steep cut slope often reduces visibility to the danger point. On fills a steep slope greatly increases the traffic hazard and forces the erection of guard rails. Flatter slopes are needed to prevent erosion, to permit seeding and sodding, and to improve appearances.

LANDSCAPE PLANTING PLANS

Detailed planning for landscape planting begins upon the completion of the engineer's general plans, which are usually prepared on a scale of 1 inch to 100 feet. Enlargements on a scale of 1 inch to 50 feet should be prepared, preferably on 22- by 36-inch standard sheets, where a comprehensive improvement is to be planned. Where the amount of planting is small the regular plans may serve as a base.

These base plans should indicate the centerline stationing, the existing and proposed road surface, edges of shoulders, ditches and slopes, right-of-way lines and markers, and physical details such as houses, fences, bridges, culverts, intersections, poles, trees, signs, guard rails, and similar objects. With these plans in hand, the landscape architect makes preliminary field studies, noting his observations on the plans.

A tentative planting lay-out is prepared in the office, which is reviewed in the field, and final plans are then prepared. These should be in the form of tracings from which any desired number of blue prints can be prepared. A complete set of plans consists of an index or title sheet, a summary sheet with tabulation of quantities, one or more detail sheets of typical sections, and several planting sheets, according to the requirements of the individual project. Typical sheets from a set of plans are shown in figures 9 and 10.

If the work is to be done under contract, complete specifications and estimates should be prepared. When it is to be done by State or local forces (force account) general instructions to the field organization may take the place of formal specifications.

Purchases of nursery-grown material should be made only through competitive bidding.

HONEYSUCKLE GROUND COVER WHICH IMPROVES APPEARANCE AND PREVENTS EROSION. FURTHER IMPROVEMENT WOULD HAVE BEEN POSSIBLE BY ROUNDING THE TOP OF THE SLOPE AT THE LEFT AND A LIMITED AMOUNT OF SELECTIVE TREE CUTTING.

The Horticultural Standards of the American Association of Nurserymen and Standardized Plant Names of the American Joint Committee on Horticultural Nomenclature are recommended for use in specifying desired material. Calls for bids should clearly state the plant species, the quantity, the grade and the size, and whether bare rooted (B.R.) or balled and burlaped (B. and B.).

ESTIMATES OF COST

The typical cost-distribution sheet shown in the Appendix on page 31 indicates the variety of items and classes of work entering into landscape improvement. All plans should be accompanied by a detailed estimate based on such a form.

INDEX OF SHEETS

DESCRIPTION	SHEET NO.
TITLE SHEET	1
SUMMARY SHEET-TABULATION OF QUANTITIES	2
DETAIL SHEET TYPICAL SECTIONS	3
PLANTING PLANS	4-12

FED. ROAD DIST. NO.	STATE	FED. AID PROJECT	FISCAL YEAR	SHEET NO.	TOTAL SHEETS
8	MISS.	E-211A	1933	1	12
STATE DIV. NO.	COUNTY	STATE PROJ. NO.		HIGHWAY NO.	

SEAL

STATE HIGHWAY DEPARTMENT

(JACKSON, MISSISSIPPI)

ROADSIDE-IMPROVEMENT PROJECT

FROM (GREENVILLE) TO (LELAND, MISS.)

RIGHT OF WAY = 100 FEET

NET LENGTH = 8.58 MILES

SCALE 1 IN. = 50 FEET

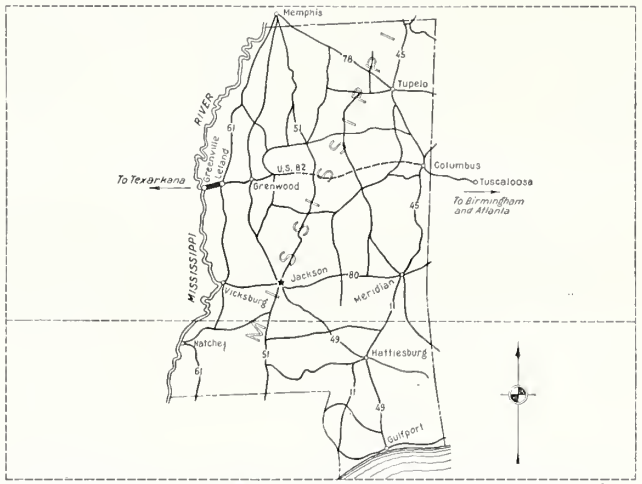
EXCEPT WHERE OTHERWISE NOTED

JULY 1933

CONVENTIONAL SIGNS

Highway engineering plans

State line
Park boundary
County line
City, town, or village
Right-of-way line (with markers) — R.O.W. ∂ Mon.
Center line ℄ (100' stations) — P.C. 25
Fence line
Unfenced property line
Fenced property line
Traveled way (present)
Traffic way (proposed surfacing)
Road traffic signs (official markers)
Wagon trail, side road, or driveway
Foot trail
Footpath or bridlepath (rural type)
Sidewalk (urban type)
Railroad or trolley
Bench mark — Δ B.M.
Bridge
Buildings — Barn
℄ of drainage
Water
Pipe culvert
Box culvert
Head wall
Drop inlet
Curb inlet
Levee or bluff
Marsh or swamp
Rock outcrops
Top of slope (in cut)
Toe of slope (in fill)
Rounding of slope intersection (cut)
Rounding of slope intersection (fill)
Fire plug
Mail box or boxes
Guard rail
Rustic guard rail
Concrete retaining wall
Rubble retaining wall
Crib retaining wall
Telephone or telegraph poles
Guy poles — G.P.
Power poles
Trolley poles
Electric transmission lines (3-wire primary)
Joint construction — or



Note: This typical standard-size title sheet is subject to rearrangement and adjustment to fit particular State requirements, as to size and shape of plan for project location, etc.

RECOMMENDED FOR APPROVAL

LANDSCAPE ENGINEER-DEPARTMENT OF HIGHWAYS

APPROVED _____ 19____

CHIEF ENGINEER-DEPARTMENT OF HIGHWAYS

RECOMMENDED FOR APPROVAL

CHIEF ENGINEER-BUREAU OF PUBLIC ROADS

APPROVED

CHIEF-BUREAU OF PUBLIC ROADS

CONVENTIONAL SIGNS

Highway landscape plans

Existing plant growth (Foliage indication at relative scale) (common (English) names)
Wood, Forest, or Grove
Deciduous tree (shade type) — 8' elm; 12" pecan
D = inch diameter at breast height (4½ ft.)
S = spread in feet, or 1/2 x inch diam.ᵗ
Evergreen tree (screen type) — 6' cedar; 18' pine
Flowering tree (small tree or shrub type) — H = height
Shrub mass (single or grouped)
Hedgerow
Clipped hedge

Proposed (to be planted) classification based on relative size at maturity (scientific (Latin) names)
Deciduous tree (shade type) — 1-Ulmus americana
Small tree (flowering type) — 1-Cornus florida
Evergreen tree — 1 Pinus virg. or 1 Jun. comm.
Specimen tree (selected large or small) — or
Planting group
Small trees (in groups)
Large shrubs (in groups)
Medium-size shrubs
(figures in feet indicate spacing) 10 Lonicera fragrantissima-6'
Ground cover (on fill)
Ground cover (in cut) — 100 Celastrus-5'8'
(first figure indicates quantity, last figure indicates spacing in feet)
To be transplanted (from → to)
To be cut (removed)
View lines
Undesirable outlooks (Billboards, etc.) — Screen

General notes:
Other special features to be indicated clearly on plan.
Edge of roadway shoulder indicates approximate planting control or limit of clearance to be permanently maintained when planting is introduced.
Rural roadside planting along shoulder slopes should be informal and natural in arrangement.
Plant materials should be messed in odd-numbered groups of 3.5.7.9. etc.
To avoid straight hard lines, plants should be placed in crescent-like curves at irregular spacing or variable distances apart, with due allowance for normal size of plant at maturity.

J.G.H.

[25]

FIGURE 9.—TYPICAL COVER PAGE FOR ROADSIDE-IMPROVEMENT PLANS.

FORMAL URBAN PLANTING

HIGHWAY ENTRANCE TO CITY OF GREENVILLE

Considerable variety is afforded in the arrangement of plant material. Town approaches may be formal in layout with rows of trees evenly spaced, and if desired, interspersed more or less regularly with smaller flowering types of material

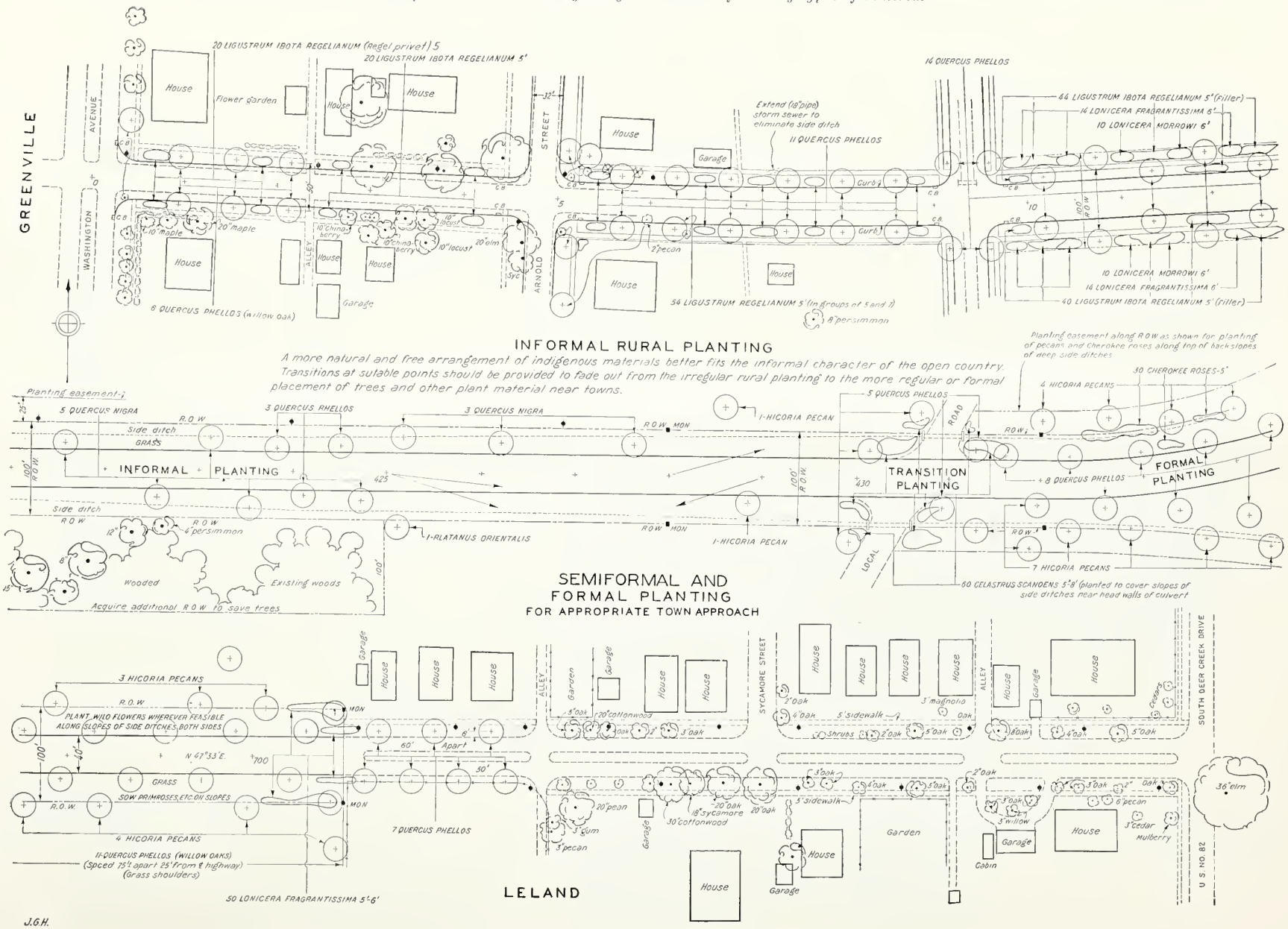


FIGURE 10.—A TYPICAL PLANTING PLAN.

There are two possible plans of carrying on preparation and planting operations as described below. Plan A is recommended as likely to produce the most satisfactory results.

Plan A.—The purchase (furnishing and delivery only) of nursery-grown plant materials on the basis of specifications as described above through contracts awarded after receiving competitive bids. The actual planting to be done by State forces (maintenance or special landscape gangs) under the direction of superintendents with actual experience and training in the work. This has been the usual practice in the past and considerably simplifies preliminary office work and the making of adjustments in the field operations to meet local conditions. Nurseries specialize in growing materials and usually do not undertake planting at a distance from the growing grounds.

Plan B.—The actual furnishing of plants and materials, delivery and planting to be done under contract according to plans and specifications and strict supervision of State landscape personnel. Contracts should specify the furnishing of all materials such as tree stakes, fertilizers, humus, and tools as well as plants. It is difficult to work under this plan as so many varying factors enter into the work. It is difficult also to find contractors with satisfactory experience.

BEFORE THE MAIN GRADING OPERATIONS THE TOPSOIL IS STRIPPED AND TRANSPORTED TO STORAGE PILES, LATER IT WILL BE DISTRIBUTED TO SUPPORT GROWTH ON BARE CUTS AND FILLS.

TOPSOIL STRIPPED FROM ROADWAY AND STORED FOR LATER USE.

TRANSPLANTING TREES FROM THE AREA TO BE OCCUPIED BY THE ROADWAY. WITH PROPER EQUIPMENT TREES OF CONSIDERABLE SIZE CAN BE READILY MOVED. THE FINE CEDAR SHOWN IN *B* IS WELL WORTH TRANSPLANTING.

CLEARING FALLEN TIMBER AND UNDERBRUSH AND TRIMMING TREES SELECTED TO REMAIN.

CARE AND DEVELOPMENT OF EXISTING GROWTH

This publication is not intended as a textbook. It does not aim to cover all methods of roadside treatment. However, it is desired to call attention to the outstanding features of such work. The care and development of existing growth is of outstanding importance. In some situations it is possible to develop extensive sections of a project or even a whole project without the addition of material from outside the project.

The effective results which can be produced are shown by various pictures throughout this publication. All trees and shrubs within the area of grading operations found to be worth transplanting should be carefully tagged and removed to temporary or permanent locations at the proper time. Trees to be removed should be clearly blazed. Specimen trees to be retained in place should be marked so as to avoid any misunderstanding by workmen.

Trees are the dominant units in the highway landscape. Woodland borders, specimen trees, and picturesque tree groups are valuable assets of any project.

The work of cutting, thinning, and tree surgery can precede or take place concurrently with grading operations, but the two kinds of work cannot be carried on simultaneously on the same section of the project without serious interference. Selective cutting to open vistas and develop desirable outlooks is an effective landscape treatment. Such work should be attempted only under the most competent supervision. The trimming of trees and other growth in an artistic and scientific manner requires detailed direction by experienced men. Careless "butchering" of trees and haphazard cutting of undergrowth can seriously damage a landscape.

The saving of topsoil to be spread over the poor soils of cuts and fills is illustrated on page 27. Topsoil is particularly valuable in supporting vegetation in rocky and gravelly areas.

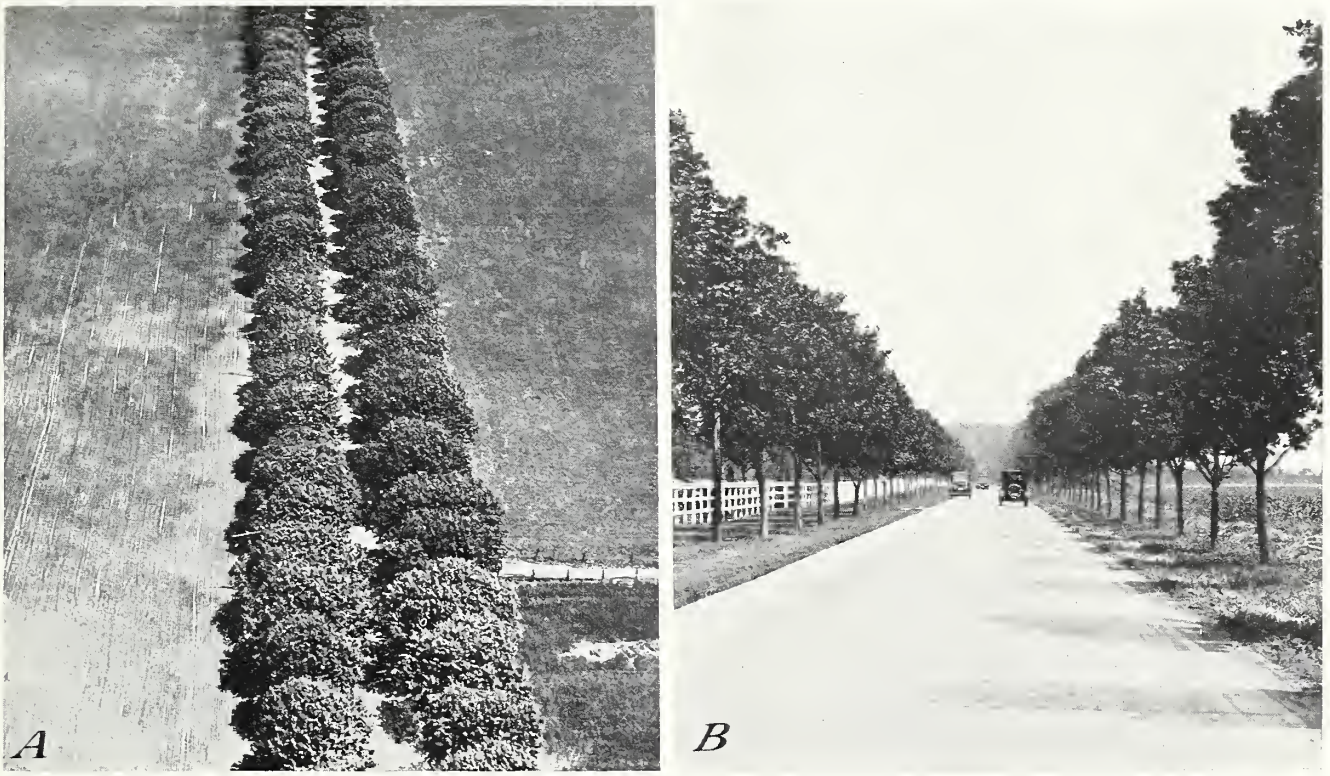
Boulders and native stone can be salvaged for guard rails and fences.

MATERIAL FOR PLANTING

The landscape planting should be in harmony with the surrounding countryside. The planting design should produce an informal arrangement of native plants carefully grouped in irregular clumps and natural masses. Exotic plants or material not native to the region are undesirable.

Formal plantings of trees, regularly spaced along each side of the road in straight rows are monotonous if continued for any distance and usually should be limited to town approaches.

Some planting material can be obtained from nearby woods and transplanted at low cost. Nurseries offer a wide variety of native types of plants and using their stock has several advantages. Considerable variety is obtainable, and nursery culture produces a better root and plant growth than is usually found in wild growth. For this reason nursery-grown stock develops more rapidly and has a higher percentage of survival than wild stock. Selection of varieties of plants should be made by the landscape architect. The selection of types will be affected by the climate, the soil, and the supplies of the material available. On several outstanding projects liberal use has been made of both native wild stock and nursery-grown plants. In planning a project it is best to canvass the nurseries of the territory with a view to the use of plants available in quantity at reasonable prices. Surplus stock of nurseries may often be used to advantage.



ROWS OF REGULARLY SPACED TREES SHOULD BE USED ONLY IN SPECIAL LOCATIONS AS WHEN APPROACHING A CITY. MILE AFTER MILE OF SUCH TREATMENT WOULD BE MONOTONOUS. INFORMAL ARRANGEMENT IS MORE IN HARMONY WITH A RURAL SETTING. THE TREES SHOWN AT *B* ARE BADLY CROWDED. (PHOTO BY BALTIMORE EVENING SUN.)

GROUND COVER IS BADLY NEEDED HERE BOTH FOR APPEARANCE AND TO PREVENT EROSION. COST OF PLANTING WILL BE MORE THAN OFFSET BY AVOIDANCE OF COST OF CLEANING DITCHES.

It is particularly emphasized that advance preparation of the soil, proper placement of roots in planting, supplying the right plant food and watering when required, are as important in producing a pleasing landscape as procuring the right kind of plants.

ENGLISH IVY BEING TRANSPLANTED FROM SMALL POTS IN A SHORT TIME WILL COVER THIS BARE AREA. CUTTINGS WERE MADE FROM IVY ON AN OLD WALL AND PROPAGATED IN A GREENHOUSE NEAR THE PROJECT.

On some projects considerable quantities of grass seed have been wasted because of improper selection and planting. There are many varieties of grasses suitable for different soil and climatic conditions. Here, again, is a problem for the landscape architect. It is a waste of seed to sow it in soil excavated from below the topsoil layer, since such soil is lacking in humus.

A. PLANTING SHRUBS IN A GRAVEL BANK. LARGE HOLES ARE DUG AND FILLED WITH SUITABLE SOIL.

B, PLANTING MUST BE CAREFULLY DONE. ONE MAN HOLDS THE PLANT, ARRANGES THE ROOTS AND TAMPS WHILE THE OTHER SHOVELS. PLANTS IN THE BACKGROUND ARE HEELED IN UNTIL NEEDED FOR PLANTING.

LANDSCAPING AND THE SEASONS OF THE YEAR

In most sections of the country the various types of work which precede planting can be carried on at all seasons of the year. Spring and fall are the seasons in which most planting and seeding operations should take place.

Much landscape work can be done during the winter months when there is the greatest need of employment. Clearing, cutting, and thinning can be done then; and the work of native collection, especially of the larger trees where a frozen ball of earth on the roots is desired, can be done during average winter conditions.

A. PLANTING TO SCREEN AN UNSIGHTLY BACKGROUND. *B*, SMOOTHING AND PREPARING SOIL PREPARATORY TO SEEDING OF GRASS.

APPENDIX

TYPICAL COST-DISTRIBUTION SHEET—ROADSIDE IMPROVEMENT PROJECT NO. .....

From ..... to .....

Superintendent's report on expenditures for material and labor from .....

to .....

Items of work	Labor cost	Cost of material, equipment, teams, and trucks	Remarks and special items
1. Design and supervision:			
A. Design (office studies):			
1. General supervision of landscape architect or engineer			
2. Plans, specifications, and estimates			
3. Field plotting, checking, and inspection			
B. Supervision:			
1. General superintendent			
2. Timekeeper (pay rolls, etc.)			
3. Bookkeeping (cost records)			
4. State or district landscape engineer			
2. Landscape-forestry improvement:			Brief description of work:
A. Selective cutting and grubbing (stumps, deadwood, etc.):			Location Station .....
			Labor hours .....
			Number of trees .....
1. Wooded areas			
2. Vistas, etc			
B. Tree work (foreman):			
1. General (pruning, etc.)			
2. Special (bracing, cavities, etc.)			
3. Miscellaneous			
3. Preparation of planting and seeding areas:			
A. Grading (general):			
1. Obliteration of construction scars			
2. Rough grading (subgrading):			
a. Flattening slopes			
1. Widening shoulders and ditches			
b. Excavating tree pits, planting beds			
3. Finished grading (raking, etc.):			
a. Rounding slopes			
b. Seeding (grass)			
B. Soil improvement:			
1. Topsoiling (cubic yards)			
2. Humus (peats, etc.)			
3. Chemical fertilizers			
4. Manure (stable)			
5. Green manuring			
6.			
C. Special construction:			
1. Scenic overlooks			
2. Picnic areas and wayside parks			
3. Footpaths or walks			
4.			
4. Planting and seeding:			
A. Native collection (local):			
1. Specimen material (large trees)			
2. Small trees			
3. Shrubs			
4. Vines (ground cover)			
B. Nursery-grown purchased stock:			
1. Shade trees (street type)			
2. Evergreen trees (screen type)			
3. Small trees (flowering types)			
4. Shrubs			
5. Vines (ground cover)			
C. Job nursery (temporary storage):			
1. Salvaged material			
2. Surplus stock			
3.			
D. Seeding:			
1. Wildflowers			
2. Sodding			
E. Pruning			
F. Staking—guying			
G. Mulching			
H. Watering			
I. Spraying			
J. Feeding (fertilizing)			

Items of work	Labor cost	Cost of material, equipment, teams, and trucks	Remarks and special items
5. Contingencies:			
A. Temporary maintenance:			
1. Cultivation			
2. Reseeding and replanting			
3. Cleaning up			
B.			
Total			
Previous accumulated totals			
Accumulated total to date			

FORCE AND EQUIPMENT DURING THIS PERIOD

Foremen
Skilled labor
Common labor
Teams
Trucks
Special equipment

Days worked
Weather report
Rain (dates)
Snow (dates)
Comments

Summary of Costs—Roadside-Improvement Project No. .....

	Design and supervision	Landscape—forestry work	Preparation of planting and seeding areas	Planting and seeding	Contingencies	Total
Total brought forward (labor, material, and equipment)						
Labor cost (this period)						
Cost of material, equipment, teams, and trucks (this period)						
Total cost to date						

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Contains news of roadside development activities, including legislation, decisions, conferences, etc. Prints reports of surveys of The National Council for the Protection of Roadside Beauty. To date, reports not printed separately have covered Georgia, Illinois, Long Island, Michigan, South Carolina, Washington (State), and Connecticut.

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Takes up value and status of movement, surveys made, legislation, etc. 1929, 1931, 1932 compilations also issued separately.

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*WOODED WAY TO MOUNT VERNON; THE MEMORIAL HIGHWAY LEADING FROM THE NATIONAL CAPITAL TO THE HOME OF WASHINGTON, EXEMPLIFIES THE IMPORTANT PART ROADSIDE FORESTRY CAN PLAY IN MOULDING FITTING APPROACHES TO GREAT SHRINES. American Forests and Forest Life, vol. 39, no. 2, February 1933, pp. 55–58, 96. (Published at 1713 K Street NW., Washington, D.C. Single numbers, 35¢.)

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REPORT. 15 p. mimeographed. 1933. (Issued by Highway Research Board, Washington, D.C.)

Conclusion is in form of six recommendations. Appendices show laws and funds for roadside development in 15 States; List of references; and, Discussion by Wilbur H. Simonson, United States Bureau of Public Roads. L. M. Keith, director, Bureau of roadside development, Connecticut State Highway Department, is chairman of the joint committee. Printed report to appear in Proceedings, Highway Research Board.

* Well illustrated.

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Paper before the Mississippi Valley conference of State highway departments. Gives details of organization and work done in Wayne County, Mich.

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Includes results of survey of State highway departments showing roadside development work included in annual programs. Gives information, by States.

BOWERS, H. D. (10)
*ROADSIDE DEVELOPMENT IN SOUTHERN CALIFORNIA BY BEAUTIFICATION PROJECTS; (and) PROGRAM OF ROADSIDE DEVELOPMENT UNDER WAY IN SOUTHERN CALIFORNIA. 2 pts. California Highways and Public Works, vol. 10, nos. 9, 10–11, September, October–November 1932, pp. 2, 32; 34–35. (Published by Division of Highways, Department of Public Works, P.O. Box 1103, Sacramento, Calif.)

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CLARKE, G. D. (15)
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*ROADSIDE WOODLAND RESERVATIONS. (Pub. no. 20.) 4 pp. New Haven, Conn., 1931.

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* Well illustrated.

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Pennsylvania. Department of Highways. (Harrisburg, Pa.) (43)
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